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Revision of the genus *Europtron* with description of *Europtron atlanticum* sp. n. from Morocco (Coleoptera: Scarabaeidae: Melolonthinae)

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Abstract. The pachydemine genus *Europtron* Marseul, 1867 is revised. Currently, three species are recognized *E. gracile* Marseul, 1867, *E. confusum* Marseul, 1878 (both from Algeria) and *E. atlanticum* sp. n. from the Atlantic coast of Morocco. The new species differs from both of the previously known North African species mainly by remarkably densely punctate and setaceous clypeus, by all around setaceous pronotum, and by shape of metatibia and parameres. The female of *E. gracile* is described for the first time, females of *E. confusum* and *E. atlanticum* sp. n. are still unknown. *Europtron ibericum* Balthasar, 1929 is considered a junior objective synonym of *E. confusum*. Known distribution of all three species is mapped and their bionomy is discussed.

Taxonomy, revision, new species, type designation, bionomy, distribution, Coleoptera, Scarabaeidae, Melolonthinae, Pachydemini, Palaearctic region

INTRODUCTION

About 200 species of Pachydemini, belonging to 19 genera, are present in the Palaearctic region (Sabatinelli & Pontuale 1998). Almost 90 species in six genera are known from North Africa (Baraud 1979, 1985, 1987a, b). Moreover, another 15 endemic *Pachydema* species were described from the Canary Islands (Baraud 1994, Lacroix in press).

The genus *Europtron* Marseul, 1867 differs from all other North African Pachydemini by the simply acuminate apices of tarsal claws. The claws are apically bifid in the remaining North African genera: *Ceramida* Baraud, 1987; *Elaphocera* Géné, 1836; *Elaphocerida* Reitter, 1902; *Pachydema* Castelnau, 1832 and *Tanyproctus* Faldermann, 1835 (Baraud 1979, 1987a). Two North African members of the genus *Europtron* have been known so far: *E. confusum* Marseul, 1878 and *E. gracile* Marseul, 1867, both from Algeria (Baraud 1979), the latter species has been also recorded from Morocco (Ahrens & Zorn 1996). The third, distinctive new species is described in the present paper. The only European species has been described by Balthasar (1929) under the name *E. ibericum* from Valencia, Spain. However, several authors have expressed their doubt about the type locality and validity of the species (e.g., Báguena Corella 1967, Baraud 1977, 1992).

MATERIAL AND METHODS

The following codes (after Arnett et al. 1993) identify the collections housing the material examined

ABCB – Czech Republic, České Budějovice, Aleš Bezděk collection;
CZCD – Germany, Dresden, Carsten Zorn collection,
DACD – Germany, Dresden, Dirk Ahrens collection;
DKCC – France, Chartres, Denis Keith collection,
DKCP – Czech Republic, Praha, David Král collection,
JBCP – Czech Republic, Praha, Jan Batelka collection,
JRCP – Czech Republic, Poděbrady, Jiří Rejsek collection,
MHNG – Switzerland, Genève, Muséum d'histoire naturelle (Ivan Löbl);
MNHN – France, Paris, Muséum national d'Histoire naturelle (Claude Girard),
NHMB – Switzerland, Basel, Naturhistorisches Museum (Eva Sprecher);
NMPC – Czech Republic, Praha, National Museum (Josef Jelínek).

Specimens of the newly described species are provided with one printed red label: "Europtron atlanticum sp. n., HOLOTYPUS or PARATYPUS with No and male sex symbol, A. Bezděk, D. Král, D. Keith & M. Lacroix det. 1999" *Exact label data are cited for the types only, separate labels are indicated by double slash (//).* Authors' remarks and complementations are found in square brackets [p] – preceding data are printed, [h] – the same but handwritten, MS – manuscript; m – male(s), f – female(s)

SYSTEMATIC PART

Europtron Marseul, 1867

Europtron Marseul, 1867: 81, Reitter 1902: 96; Dalla Torre 1913: 302 (catalogue); Balthasar 1929: 41, Winkler 1929: 1095 (catalogue); Báguena Corella 1967: 326; Baraud 1977: 283; 1979: 309; 1985: 394; 1992: 569

TYPE SPECIES. *Europtron gracile* Marseul, 1867 (by monotypy).

DIAGNOSIS. Male. Small to medium-sized beetles (body length 5.0–8.5 mm). Body elongate, convex, dorsal surface shiny.

Clypeus feebly semielliptic with distinctly upturned margin. Labrum small, narrow, flattened, hardly visible. Eye-canthus present, short. Frons bare. Antenna with ten antennomeres, club pentamerous, globular, distinctly shorter than antennal shaft. Terminal maxillary palpomere elongate, parallel, dorsally without excavation.

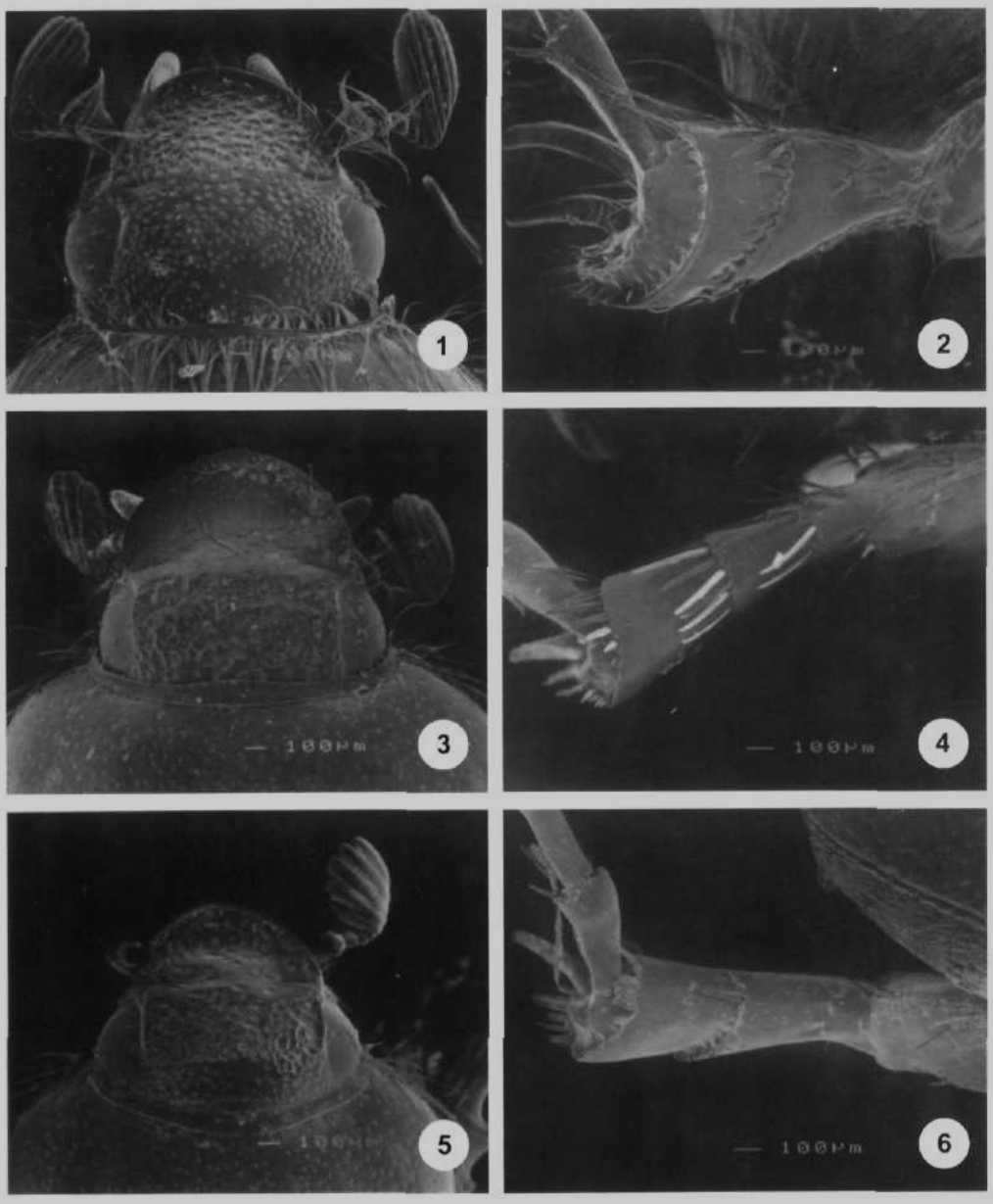
Pronotum convex, transverse; with all sides rimmed, anteriorly without membraneous margin, lateral margin with row of long, erect setae. Elytron convex, rounded apically, bare; striae feeble or obsolete. Macropterous.

Protibia tridentate, basal dent in some specimens of *E. atlanticum* sp. n. almost obsolete. Terminal calcar slim, inserted against emargination between median and apical dents. Mesotibial calcars inequal. Posterior tibia short, widened apically, with medial transverse carina; terminal calcars slim, not dilated apically. Posterior femur remarkably short and stout. Tarsi elongate, tarsomeres simple, cylindrical, with bare ventral side. Claws long, equal, slim, ventrally not denticulate, simply acuminate apically (not bifid).

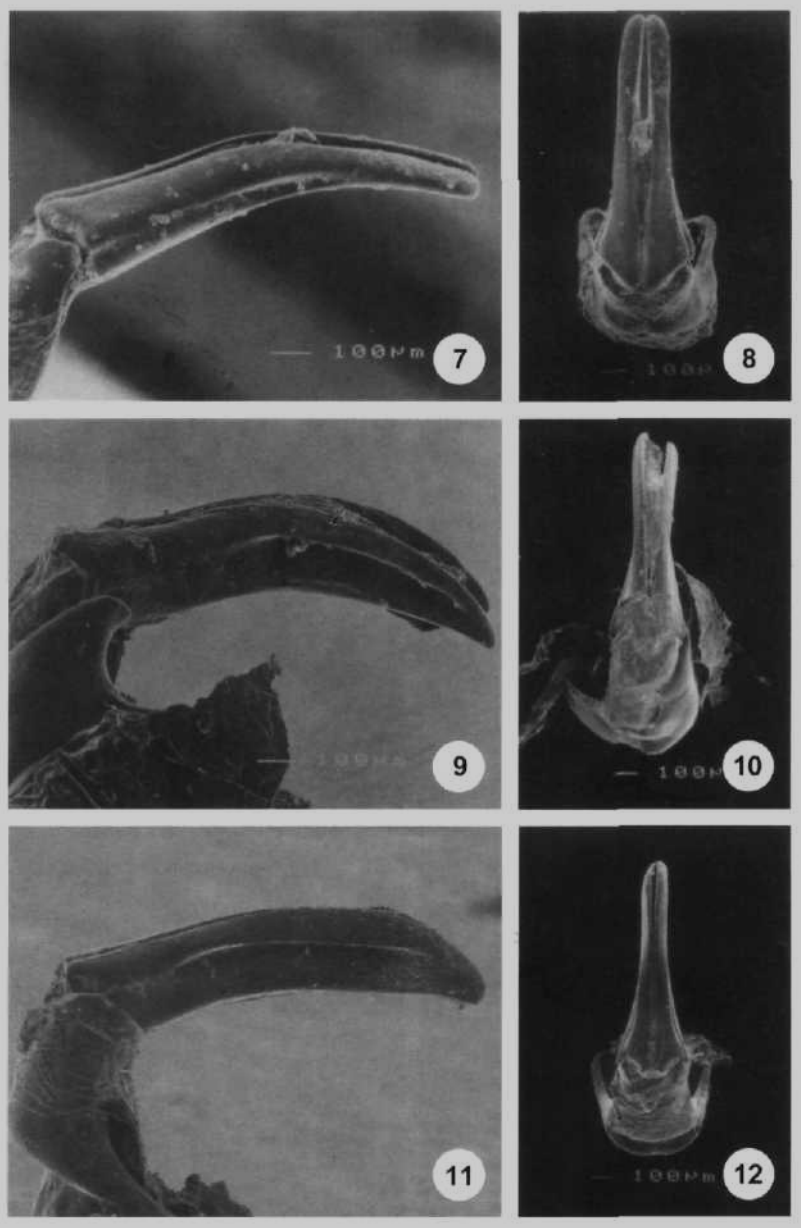
Pygidium short, rounded apically.

Sexual dimorphism distinctly pronounced in *E. gracile* (females of *E. confusum* and *E. atlanticum* sp. n. are still unknown): females remarkably larger and more robust than males (cf. Figs 13, 25), apterous, eyes much smaller, only slightly visible in dorsal aspect, minute anterior claws and lacking of terminal calcar of protibia.

DISTRIBUTION. North Africa: Morocco, Algeria; ? Spain.



Figs 1–6. Head (odd numerals) and posterior tibia (even numerals). *Europtron atlanticum* sp. n. (paratypus No 2) (1–2); *E. confusum* Marseul (Algeria: Laghouat) (3–4); *E. gracile* Marseul (Algeria: El Goléa) (5–6).



Figs 7–12. Lateral aspect (odd numerals) and dorsal aspect (even numerals) of parameres. *Europtron atlanticum* sp. n. (paratypus No 2) (7–8); *E. confusum* Marseul (Algeria: Laghouat) (9–10); *E. gracile* Marseul (Algeria: El Goléa) (11–12).

Europtron atlanticum sp. n.
(Figs 1–2, 7–8)

Europtron gracile Ahrens & Zorn 1996. 11

TYPE MATERIAL. All males Holotype and 14 paratypes Nos 1–14, labelled: Morocco 1997, AGLOU PLAGE, 7.5 [19]97, 15 km N of Tiznit, Batelka et Podrouzkova [Podroužková] lgt. [p]; 4 paratypes, Nos 15–18, labelled: *Morocco 1998, Aglou Plage / 15 km NW of TIZNIT, 21.6.1998, Jan Batelka et Hana Batelkova [Batelková] lgt.* [p]. 2 paratypes, Nos 19, 20, labelled: MAROC 25 m, Tiznit 12.IV[19]99, Aglou-Plage, Keith & Ollivier [lgt] [p]. 5 paratypes, Nos 21–25 labelled: SOUTH MOROCCO, Sidi Rbat/Qued Massa, 50 km S of Agadir, 24.III.[19]93, leg. C. Zorn [p]. 2 paratypes Nos 26, 27, labelled: Maroko – S.W., MASSA, Rejsek [lgt.], 10.5.1993 [p]. Holotype and paratypes Nos 1 and 20 in MNHN, paratypes Nos 2–4 and 25 in ABCB, paratypes Nos 5, 6 and 22, 23 in CZCD, paratypes Nos 7–9 and 24 in DKCP, paratypes Nos 10–14 in JBCP, paratypes Nos 15,16 in NMPC, paratypes Nos 17,18 in MHNG, paratype No 19 in DKCC, paratype No 21 in DACD; paratypes Nos 26, 27 in JRCP.

ADDITIONAL MATERIAL EXAMINED. **Morocco, Mogador** [= Essaouira]: 1 m in MHNG (coll. R. Petrovitz).

DESCRIPTION. Body length 5.0–8.5 mm (holotype – 7.0 mm, 26 specimens measured). Body elongate, subparallel. Dorsal surface shiny, colour chestnut to dark brown, clypeus in some specimens paler than the rest of head, elytra yellowish with dark suture. Ventral surface shiny, chestnut to dark brown. Setation pale.

Head (Fig. 1). Clypeus semielliptic with distinctly upturned margin. Surface coarsely and densely punctate; punctures separated by approximately their diameter; surface covered with short, erect setae. Frontoclypeal suture absent. Vertex bare, finely and densely punctate. Eye-canthus with several long, erect setae; angle between lateral margin of clypeus and canthus obtuse. Antenna with ten antennomeres, antennomere 1, 2 and 3 elongate, antennomere 2 longer than antennomere 3, antennomere 4 and 5 strongly transverse, antennomere 1 and 2 covered with long, erect setae, antennomere 3–5 covered with short, erect setae; club pentamerous, distinctly shorter than antennal shaft. Terminal maxillary palpomere elongate, apically rounded, about twice as long as palpomeres 2 and 3 combined.

Pronotum convex, transverse, about twice as wide as long, widest approximately in anterior third, base broader than anterior margin; all sides distinctly rimmed with a row of long, erect setae; anterior and posterior angles obtusely angulate; anterior pronotal concavity almost lacking.

Scutellum semielliptic, slightly wider than long, posterior margin broadly rounded; finely and sparsely punctate.

Elytron convex, in basal half nearly parallel, narrowed apically; bare; punctation simple, irregular, coarse and dense; striae not indicated; lateral margin with a row of erect setae, that are distinctly shorter than those in marginal row of pronotum; sutural interval flat.

Ventral surface covered with moderately dense, long setae.

Protibia tridentate, basal dent in several specimens almost obsolete; terminal calcar slim, long, inserted against emargination between median and apical dents. Claws regularly curved, simply acuminate apically. Posterior femur short, broad, coarsely punctate. Posterior tibia (Fig. 2) short, stout, strongly dilated apically; apical transversal surface strongly convex; outer surface almost impunctate except several setae at base and two transversal setiferous rows of punctures; inner surface densely punctate, and covered with long, hair-like, erect setae. Both terminal calcars dorsally convex, ventrally flattened, and apically rounded.

Propygidium almost bare, only apical margin covered with a row of short setae. Pygidium with all sides rimmed, except medial part of basal margin, basal half sparsely punctate, with long erect setae, apical half impunctate.

Paramere (Figs 7–8) long, rounded apically, in lateral aspect remarkably narrow in apical third.

Female unknown.

DIFFERENTIAL DIAGNOSIS – see Table 1.

NAME DERIVATION. The specific name refers the geographical distribution (western part of Morocco, near the Atlantic Ocean) – see Fig. 26.

COLLECTION CIRCUMSTANCES. Specimens from Sidi Rbat were captured sitting on lower vegetation in a flower-rich dune habitat, at about 3 p. m. They were remarkably active (C. Zorn pers. comm.). Specimens from Tiznit (May 1997) were collected at dusk emerging from sand dunes, but no specimen has been collected at light; specimens from Tiznit (June 1998) were captured in flight above sand dunes at about midday (J. Batelka pers. comm.). Specimens from Tiznit (April 1999) were collected in the afternoon sitting on yellow flowers of Asteraceae. The weather was sunny and windy. Males of the species seem to be polliniphagous.

COMPLEMENTARY NOTE. The specimen from Mogador [= Essaouira], deposited in MHNG is a male, but its abdomen is somewhat damaged and the aedeagus is missing. Therefore the authors have decided to exclude this specimen from the type series.

DISTRIBUTION. Morocco: Aglou Plage – type locality, Sidi Rbat, Mogador (this paper).

Europtron confusum Marseul, 1878

(Figs 3–4, 9–10)

Europtron confusum Marseul, 1878: 60; Reitter 1902: 96; Dalla Torre 1913: 302 (catalogue), Winkler 1929: 1095 (catalogue); Baraud 1979: 310; 1985: 396

Europtron ibericum Balthasar, 1929: 41 (type locality: Valencia); Báguena Corella 1967: 326, Baraud 1977: 283, 1992: 570, **syn. n.**

TYPE LOCALITY. Laghouat (Marseul 1878).

TYPE MATERIAL EXAMINED. *Europtron confusum*: Lectotype (m, length 7.0 mm), labelled: Europtron confusum Laghouat 78 [blue round label, h] // J. B., Laghouat [green round label, h] // confusum M. Ab. 16.60 Alg. // Lectotype / / Europtron confusum Marseul, M. Lacroix det. 1999, in MNHN [designated as holotype by Baraud (1979)]. *Europtron ibericum*: Holotype (m), labelled: Valencia Hispania [p] // Typus [red label, p] // Europtron ibericum m. [Balthasar's MS] // Europtron ibericum Balthasar, 1929 HOLOTYPUS David Král des. 1999 [red label, p] // Europtron confusum Marseul, 1878 David Král det. 1999 [p], in NMPC (coll. V. Balthasar)

ADDITIONAL MATERIAL EXAMINED: **Algeria, Biskra:** Dumont [lgt.], 1 m in MNHN (coll. P. Peyerimhoff); **Brezina:** 70 km mer. El Bayadh, 850 m, June 6, 1986, Březina lgt., 1 m in DKCP; **El Goléa:** February 1919, Surcouf [lgt.], 4 m in MNHN (coll. P. Peyerimhoff), **Laghouat:** J. Dayrem [lgt.], 1 m in MHNG, 7 m in MNHN (coll. A. Chobaut), 2 m in MNHN (coll. A. Demaison), 1 m in MNHN (coll. R. Demoflys), 32 m in MNHN (coll. R. Oberthür), 5 m in MNHN (coll. M. Pic), 2 m in NHMB, 2 m in NMPC; **Zirara:** El Goléa env., November 1918, Surcouf [lgt.] 1 m in MNHN (coll. P. Peyerimhoff).

DIAGNOSIS. For the diagnosis see Table 1.

COMPLEMENTARY NOTES. Specimen designated as "holotype" of *E. confusum* by Baraud (1979) is in fact the lectotype (see Article 74 (b) in the ICZN 1985).

The description of *E. ibericum* was based on one specimen from Valencia, Spain (Balthasar 1929). One of the authors (D. Král) has examined type specimen (male) of *E. ibericum*, which is deposited in NMPC. This specimen is without any doubt conspecific with *E. confusum*.

DISTRIBUTION (Fig. 26). Algeria: Laghouat – type locality (Marseul 1878; repeated by Reitter 1902, Baraud 1979, 1985); Biskra, Brezina, El Goléa, Zirara [El Goléa env.] (this paper). The type locality of *E. ibericum*, Spain: Valencia (Balthasar 1929), seems to be doubtful, and is probably based on a mislabelled specimen (see Discussion).

Europtron gracile Marseul, 1867
(Figs 5–6, 11–25)

Europtron gracile Marseul, 1867: 81; Reitter 1902: 96; Dalla Torre 1913: 302 (catalogue); Winkler 1929: 1095 (catalogue); Kocher & Reymond 1954: 222; Thérond & Hollande 1965: 871; Baraud 1979: 309; 1985: 395.
Europtron Bayonnei Chobaut, 1896: 413 (type locality: Ghardaïa); Reitter 1902: 96 (syn. to *E. gracile*); Dalla Torre, 1913: 302 (catalogue); Winkler 1929: 1095 (catalogue).
Europtron bayonnei: Baraud 1979: 309 (syn. to *E. gracile*, lectotype designation), 1985: 396 (syn. to *E. gracile*).

TYPE LOCALITY. Ouargla (Marseul 1867).

TYPE MATERIAL EXAMINED. *Europtron gracile*. Lectotype (m, length 6.0 mm), labelled: Callicnemis sp. n., [illegible word], Ouargla dec 67 [blue round label, h] // Pachydema ou Callicnemis [rectangular label, h] // bte Marseul n° 37 [h] // gracile Mars. Ab. 67 '81' Ouargl[a] [h] // Europtron Mars Ab 67. 82' [blue round label, h] // Museum Paris Col. Marseul [p] // Holotype [Baraud's label] // Lectotype // Europtron gracile Marseul, M. Lacroix det. 1999, in MNHN (coll. S.A. Marseul) [specimen designated as holotype by Baraud (1979)]. *Europtron bayonnei*. Lectotype (m, length 6.0 mm), labelled: Ghardaïa Dr. Chobaut // Type // Europtron Chob. Bayonnei Chob. [Chobaut's MS] / / Lectotype // Europtron bayonnei Chobaut, M. Lacroix det. 1999, in MNHN (coll. A. Chobaut) [lectotype designated by Baraud (1979)].

ADDITIONAL MATERIAL EXAMINED. **Algeria**, **Béni Abbès:** 1936, Dr. Ducros [lgt.], 1 m in MNHN (coll. P. Peyerimhoff); March 1947, swimming-pool, Raymond lgt., 3 m and 2 f in MNHN (coll. P. Peyerimhoff); Saoura, April 1960, 3 m in MNHN (coll. A. Hollande); 27.–28.iv.1987, David Král lgt., 1 m in ABCB, 17 in DKCP; **El Goléa:** 1934, L. Chopard [lgt.], 2 m in MNHN; May 1942, R. Paulian [lgt.], 19 m in MNHN; 29.–30.iv.1987, D. Král lgt., 4 m in ABCB, 32 m in DKCP; **Ghardaïa:** May 1897, 5 m in MNHN (coll. L. Bedel), 748 m in MNHN (coll. A. Chobaut), 15 m in MNHN (coll. L. Fairmaire), 1 m in MNHN (coll. R. Oberthür), 2 m in MNHN (coll. A. de Perrin), 3 m in MNHN (coll. A. Puton); 1 m in NMPC (coll. V. Balthasar); Dr. Chobaut [lgt.], 3 m in MNHN (coll. A. Chobaut) 1 m in NHMB (coll. G. Frey); **M'zab:** 3 m in MHNG, 4 m in NHMB (coll. G. Frey), 2 m in NMPC, 3 m in NMPC (coll. V. Balthasar); **Timimoun:** 28.–29.iv.1987, D. Král lgt., 1 m in ABCB, 3 m in DKCP.

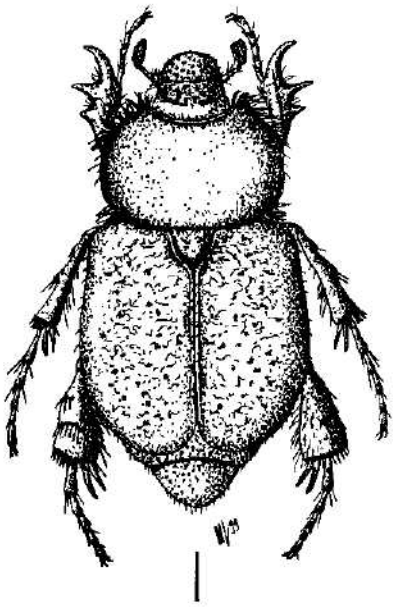
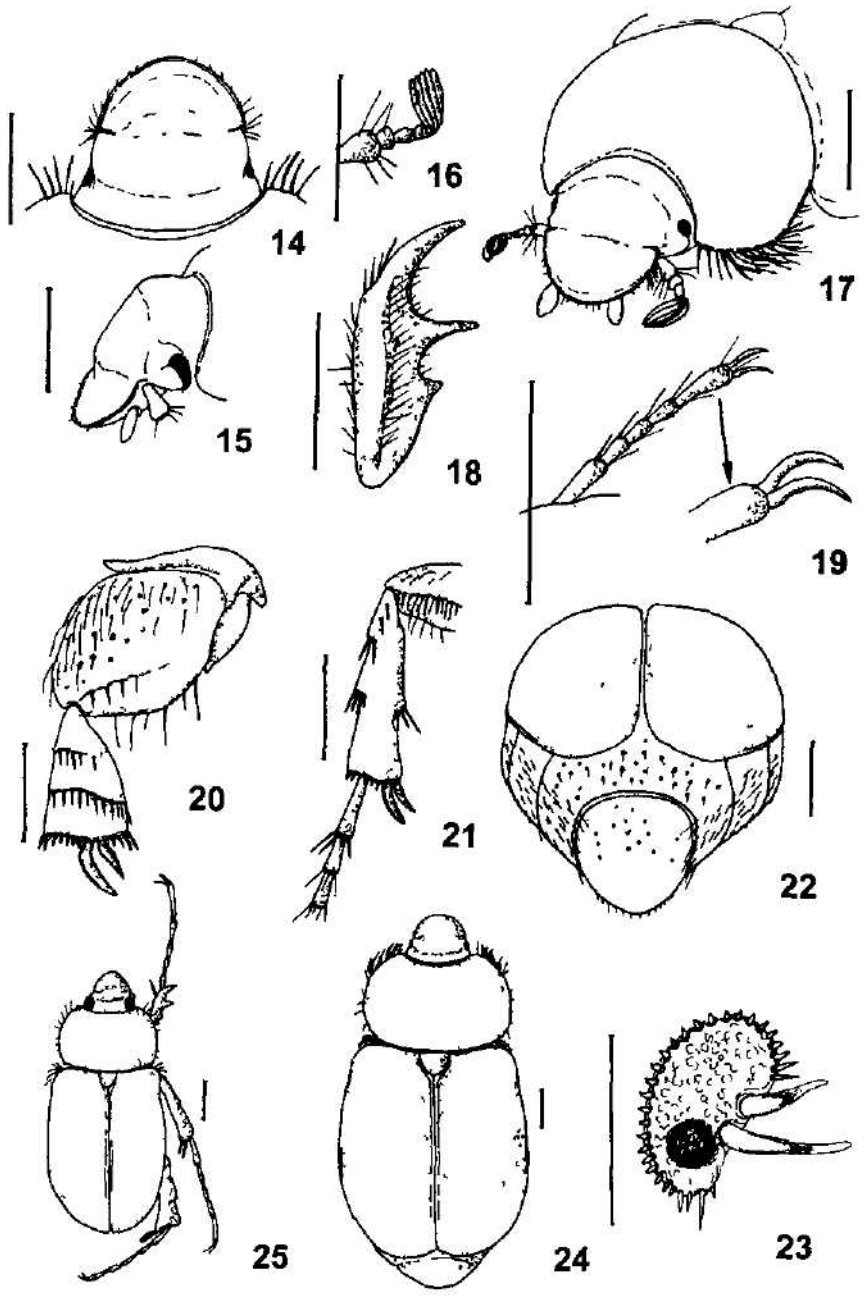


Fig. 13. *Europtron gracile* Marseul (Algeria: Béni Abbès), female habitus (drawing by M. Lacroix).



Figs 14–25 *Europiron gracile* Marseul (Algeria Beni Abbes), female (14–24) male (25) 14 – head, dorsal view, 15 – head lateral view 16 – antenna, 17 – head and pronotum, 18 – protibia 19 – protarsus and claws, 20 – metafemur and metatibia 21 – mesotibia, 22 – propygidium and pygidium, 23 – apex of metatibia with spurs 24 – schematic shape of the body, 25 – schematic shape of the body (drawings by M Lacroix) Scale = 1 mm

Tab. 1 Character matrix for separation of males of the species of the genus *Europtron* Marseul

character	*E. atlanticum* sp. n	*E confusum*	*E gracile*
body length	5 0-8 5 mm	6.5-7 0 mm	4 5-7.5 mm
colour	head and pronotum chestnut to dark brown, elytra yellowish	head and pronotum dark brown, elytra chestnut to dark brown	unicolorous, yellowish brown
clypeus	coarsely and densely punctate and setaceous (Fig. 1)	with several shallow punctures, bare (Fig 3)	with several shallow punctures, bare (Fig 5)
shape of clypeus	semielliptic	ogival	ogival
frons	flat	flat	deflexed in the middle
vertex	finely densely punctate	remarkably rugose	remarkably rugose
terminal maxillar palpomere	apically rounded	apically feebly acuminate	apically feebly acuminate
anterior pronotal concavity	almost lacking	almost lacking	distinctly impressed
anterior and posterior pronotal margin	setaceous	bare	bare
pronotum	coarsely and densely punctate	coarsely and sparsely punctate	finely and sparsely punctate
scutellum	wider than long	as wide as long	as wide as long
punctation of elytron	simple, coarse and dense	double, coarse and dense	double, fine and dense
sutural interval of elytron	flat	remarkably convex	flat
protibia	tridentate, basal dent obsolete	tridentate	tridentate
metafemur	coarsely punctate	almost impunctate	almost impunctate
shape of metatibia	apical transversal surface strongly convex (Fig. 2)	apical transversal surface more or less flat (Fig 4)	apical transversal surface more or less flat (Fig 6)
claws	shorter, regularly curved	shorter, regularly curved	remarkably long, curved in apical third only
paramere	in lateral aspect remarkably narrow in apical third (Fig 7)	in lateral aspect not remarkably narrow (Fig. 9)	in lateral aspect not remarkably narrow (Fig 11)

DESCRIPTION OF FEMALE (Fig. 13). Body length 9.0 mm (2 specimens measured). Body robust, broad, with rounded sides (Fig. 24). Dorsal surface moderately shiny, bare, reddish brown. Apterous.

Head. Clypeus large, subsemicircular, anterior margin with a median, minute, acute point. Clypeus and frons densely and rugosely punctate; vertex finely punctate. Frontoclypeal suture incomplete, in the middle broadly interrupted (Fig. 14). Eye-canthus wide (Fig. 15); eyes very small, hardly visible from above. Antenna with ten antennomeres, antennomeres 1 and 3 elongate, antennomere 2 trapezoidal, antennomeres 4 and 5 strongly transverse, club pentamerous, distinctly shorter than antennal shaft, antennomere 10 shorter than antennomeres 6–9 combined (Fig.16). Terminal maxillary palpomere broad (Fig. 17).

Pronotum convex, all sides distinctly rimmed, lateral sides with a row of long erect setae (Fig. 17). Surface of pronotum moderately densely and finely punctate. Anterior pronotal concavity indistinct.

Scutellum semielliptic, with rounded apex (Fig. 13).

Elytron convex, bare; sutural interval elevated. Apex of elytron broadly rounded (Fig. 22).

Protibia tridentate, basal dent very distinct, median and apical dents long, with acute apex; terminal calcar absent (Fig. 18). Anterior tarsus short, with very minute claw (Fig. 19). Mesotibia

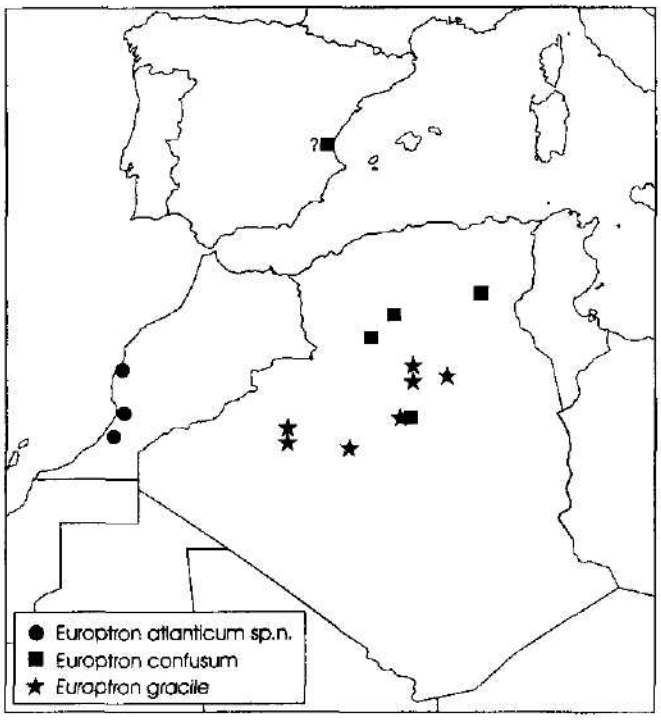


Fig. 26 Map of distribution of the genus *Europtron* Marseul. Question mark indicates the type locality of *E. ibericum* Balthasar.

elongate, median tarsus with basotarsomere longer than tarsomeres 2 and 3 combined. Posterior femur short, globular (Fig. 20). Metatibia very short, strongly dilated apically, both terminal calcars flat (Fig. 23). Posterior tarsus short, with tarsomeres moderately enlarged.

Propygidium exposed, densely puctate and covered with short setae (Fig. 22).

DIAGNOSIS. For the diagnosis see Table 1.

COLLECTION CIRCUMSTANCES. All specimens (males) collected by D. Král were captured at night, attracted by the street illuminescence in intravillan of the oases mentioned. All three localities are surrounded by sand dunes.

COMPLEMENTARY NOTE. Specimen designated as "holotype" of *E. gracile* by Baraud (1979) is in fact the lectotype (see Article 74 (b) in the ICZN 1985).

Ahrens & Zorn (1996) recorded *E. gracile* from Morocco on the basis of several specimens collected in Sidi Rbat. The authors examined these specimens and found, that all of them belong in fact to *E. atlanticum* sp. n.

DISTRIBUTION (Fig. 26). Algeria: Ouargla – type locality (Marseul 1867; repeated by Reitter 1902 [as l'Quargla], Thérond & Hollande 1965, Baraud 1979, 1985), Béni Abbès (Thérond & Hollande 1965), Ghardaïa (Chobaut 1896 – type locality of *E. bayonnei*, Baraud 1985), El Goléa, Metlili (Baraud 1985), Ougarta (Kocher & Reymond 1954), M'zab [Ghardaïa env.], Timimoun (this paper).

DISCUSSION

While *Europtron gracile* seems to be a typical nocturnal species, *E. atlanticum* sp. n. apparently exhibits true diurnal activity. Lacroix (1994) mentioned a similar diurnal activity for *Canudema socotrae* Lacroix, 1994 and *Eucyclophylla namaqua* Evans, 1987. However, he states that this kind of behaviour is not common in Pachydemini, which are mainly crepuscular or nocturnal insects and good flyers that are mostly captured at light.

This assertion should be somewhat revised: during the same trip when paratypes of *E. atlanticum* sp. n. Nos 19–20 were captured, a large series of *Pachydema anthracina* Fairmaire, 1860 was found near Essaouira during day-time. Two females were observed feeding on yellow flowers of small plants of the family Brassicaceae, while males were flying around near the ground searching for females. Females showed an evident erratic behaviour; they seemed to be emitting pheromones to attract males, and often a single female sitting on the grass was surrounded by several males. From the zoogeographical point of view, both of the previously known *Europtron* species (*E. gracile* and *E. confusum*) are typical Sahara elements, that are highly probably confined to sand dunes covered with sparse vegetation (localities Béni Abbès, El Goléa and Timimoun). Both species are absent from the sea shore dunes in the whole African Mediterranean area. For this reason, the record from Valencia (Balthasar 1929 as *E. ibericum*) is most probably based on a mislabelled specimen. On the other hand, *E. atlanticum* sp. n. seems to be closely tied with sea shore dunes of the Atlantic Sea in Morocco and it seems to be endemic for this region like several other scarabaeid species, e.g., *Amphimallon insculptum* Brenske, 1889; *Pachydema emflusi* Escalera, 1914 and *Hontoriella elaphoceroides* Escalera, 1914.

Acknowledgements

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REFERENCES

AHRENS D. & ZORN C. 1996: Interessante Scarabaeoidea-Funde (Col.) aus Marokko, mit Bemerkungen zur Taxonomie der Aphodius sphacelatus PANZ.-Gruppe. *Entomol. Nachr. Ber.* **40**: 11–17.

ARNETT H. R. Jr., SAMUELSON G. A. & NISHIDA G. M. 1993: *The insect and spider collection of the world. Flora and Fauna Handbook No. 11, Second Edition*. Gainesville: Sandhill Crane Press, 308 pp.

BÁGUENA CORELLA L. 1967: *Scarabaeoidea de la Fauna ibero-balear y pirenaica*. Madrid: Instituto Español de Entomologia, 576 pp.

BALTHASAR V. 1929: Nový druh rodu Europtron Mars. ze Španělska (Eine neue Europtron-Art aus Spanien). *Čas. Čs. Společ. Entomol.* **26**: 41–42 (in Czech and German).

BARAUD J. 1977: Coléoptères Scarabaeoidea, Faune de l'Europe occidentale. Belgique, France, Grande-Bretagne, Italie, Péninsule ibérique. *Suppl. Nouv. Rev. Entomol.* **7**(3): 5–352 pp.

BARAUD J. 1979: Coléoptères Scarabaeoidea de l'Afrique du Nord. 3e note: les Pachydemini. *Annls. Soc. Entomol. Fr. (N. S.)* **15**: 247–310.

BARAUD J. 1985: *Coléoptères Scarabaeoidea. Faune du Nord de l'Afrique du Maroc au Sinai. Encycl. Entomol., 46*. Paris: Editions Lechevalier, 651 pp.

BARAUD J. 1987a: Révision des Elaphocera d'Europe (Coléoptères, Melolonthidae). *Annls. Soc. Entomol. Fr. (N. S.)* **23**: 125–134.

BARAUD J. 1987b: Coléoptères Scarabaeoidea du Nord de l'Afrique. addenda et corrigenda. *Annls. Soc. Entomol. Fr. (N. S.)* **23**: 351–366.

BARAUD J 1992 *Coleoptères Scarabaeoidea d Europe Faune de France 78* Lyon Fed Fr Soc Entomol & Soc Linn de Lyon, 856 pp
BARAUD J 1994 Coleoptères Scarabaeoidea des Archipels atlantiques, Açores, Canaries et Madère (Suite et fin) *Bull Mens Soc Linn Lyon* **63:** 73–96
CHOBAUT A 1896 Description d'un Melolonthide nouveau du Sud Algerien (Col) *Annls Soc Entomol Fr* **45** 413–414
DALLA TORRE K W von 1913 Fam Scarabaeidae Subfam Melolonthinae Pp 291–450 In JUNK W & SCHENKLING S (eds) Coleopterorum Catalogus, Vol XX, pars 50 Berlin W Junk, 450 pp
ICZN 1985 *International Code of Zoological Nomenclature 3rd Edition* London International Trust for Zoological Nomenclature, 338 pp
KOCHER L & REYMOND A 1954 Entomologie Pp 191–260 In JOLY F, POUEYTO A, GUINET Ph, SAUVAGE Ch, PANOUSE J -B, VACHON M, KOCHER L & REYMOND A (eds) Les Hamada Sud-Marocaines *Trav Inst Sci Cherifen, Ser Géner* **2** 1–289
LACROIX M 1994 Pachydeminae des régions limitrophes du Golfe d'Aden et description de Canudema socotrae n gen , n sp (Coleoptera, Scarabaeoidea, Melolonthidae) *Rev Fr Entomol (N S)* **16** 153–170
LACROIX M 1999 Contribution a la connaissance des Pachydeminae du paleartique occidental II Une nouvelle espèce du genre Pachydema Castelnau des Iles Canaries (Coleoptera, Scarabaeoidea, Melolonthidae) *Rev Fr Entomol (N S)* **21** in press
MARSEUL S A de 1867 Descriptions d'espèces nouvelles (Europtron gracile) *L Abeille* **4** 80–82
MARSEUL S A de 1878 Melanges (suite) *L Abeille* **16** 54–60
REITTER E 1902 Bestimmungs-Tabelle der Melolonthidae aus der europaischen Fauna und den angrenzenden Landern, enthaltend die Gruppen der Pachydemini, Sericini und Melolonthini III Teil *Verhandl Naturforsch Verein Brunn* 40(1901) 93–303
SABATINELLI G & PONTUALE G 1998 Melolonthinae and Pachydeminae of Arabia (Coleoptera Scarabaeoidea Melolonthidae) *Fauna of Arabia* **17** 107–146
THEROND J & HOLLANDE A 1965 Contribution a l'etude des Coleoptères de la region de Beni Abbes et de la vallée de la Saoura *Annls Soc Entomol Fr (N S)* **1** 851–877
WINKLER A 1929 Lamellicornia Pp 1025–1134 In *Catalogus Coleopterorum regionis palaearcticae, pars 9* Wien A Winkler pp 1009–1136

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Subspecific taxonomy of *Leistus montanus* from Central Europe (Coleoptera: Carabidae: Nebriini)

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Abstract. Three new subspecies of *Leistus* (*Pogonophorus*) *montanus* Stephens, 1827 are described and illustrated *L.* (*P.*) *montanus corconticus* ssp. n. from Krkonoše Mts (= Giant Mts.), bordering Bohemia and Poland, *L.* (*P.*) *montanus kultianus* ssp. n. from Bohemia and Germany, and *L.* (*P.*) *montanus pawlowskii* ssp. n. from Babia Góra Mts., bordering southern Poland and northwestern Slovakia. *L. montanus* is for the first time recorded from Slovakia

Taxonomy, descriptions, new subspecies, Coleoptera, Carabidae, *Leistus montanus*, Czech Republic, Germany, Poland, Slovakia

INTRODUCTION

The present subdivision of the genus *Leistus* Frölich, 1799 was published by Perrault (1980, 1982, 1992). In this concept, the subgenus *Pogonophorus* Latreille, 1802 contains several taxa, of which three species groups have to be taken into consideration for central Europe: *L. spinibarbis*-group, *L. rufomarginatus*-group and *L. ovipennis*-group (sensu Perrault 1982). The *L. spinibarbis*-group contains, in addition to the species previously assigned to the subgenus *Oreobius* K. Daniel, 1903 (*L. apfelbecki* Gangelbauer, 1892, *L. glacialis* Fiori, 1899, *L. gracilis* Fuss, 1860, *L. imitator* Breit, 1914, *L. noesskei* Bänninger, 1931, *L. punctatissimus* Breit, 1914, *L. pyrenaeus* Kraatz, 1863, *L. rousi* Pulpán et Reška, 1977, and *L. ucrainicus* Lazorko, 1954), the species *L. spinibarbis* (Fabricius, 1775), *L. magnicollis* Motschulsky, 1865 and the complex of *L. montanus* (see Assman 1993, Horvatovich 1971 and Perrault 1991, 1992). Recently, the following taxa are assigned to the latter complex as separate species: *L. parvicollis* Chaudoir, 1869, *L. puncticeps* Fairmaire et Laboulbène, 1854 and *L. montanus* Stephens, 1828.

MATERIAL AND METHODS

This study is based on 914 specimens of *Leistus montanus* from 66 private and public collections. When referring to these collections in the text, the following abbreviations are used:

cBER – collection of Radek Beran (Liberec, CZ), **cBUL** – collection of Petr Bulirsch (Lovosice, CZ), **cČER** – collection of Zdeněk Černy (Mirovice, CZ), **cČRV** – collection of Radek Červenka (Praha, CZ), **cDVO** – collection of Miroslav Dvořák (Praha, CZ), **cFAR** – collection of Jan Farkač (Praha, CZ), **cFRE** – collection of Frey (Naturhistorisches Museum Basel, CH), **cFSS** – collection of †Miloš Fassati (Muséum d'histoire naturelle Geneve, CH), **cGEB** – collection of Jorg Gebert (Rohne, D); **cGTT** – collection of Josef Gottwald (Naturhistorisches Museum Basel, CH), **cHÁV** – collection of Jiří Háva (Praha, CZ), **cHEI** – collection of Walter Heinz (Schwanfeld, D), **cHEJ** – collection of Jiří Hejkal (Kraslice, CZ), **cHON** – collection of Miroslav Honců (Česká Lípa, CZ), **cHOV** – collection of Oldřich Hovorka (Dobříš, CZ), **cHŮR** – collection of Karel Hůrka (Praha, CZ), **cCHV** – collection of Jiří Chvalkovský (Česká Lípa, CZ); **cJAN** – collection of Miroslav Janata (Praha, CZ); **cJAR** – collection of Miloš Jaroš (Litoměřice, CZ), **cJUR** – collection of Josef Jurčíček (Praha, CZ), **cKAB** –

collection of Petr Kabatek (Praha, CZ), **cKAŠ** – collection of Ludvik Kašpar (Česka Lipa, CZ), **cKLI** – collection of Libor Klima (Ostrava, CZ) **cKME** collection of Rudolf Kmeco (Litovel, CZ) **cKOV** – collection of Milan Kovařik (Praha, CZ) **cKRA** collection of David Kral (Praha, CZ), **cKUČ** – collection of Pavel Kučera (Liberec CZ) **cLAK** – collection of Jan Lakota (Hriňova, SK), **cLIN** – collection of Martin Linhart (Praha, CZ) **cLOH** – collection of Roman Lohaj (Košice, SK), **cMKA** – collection of Zdeněk Malinka (Opava, CZ), **cMAL** – collection of Vladislav Maly (Praha, CZ), **cMAR** – collection of Ivan Mareček (Praha, CZ) **cMGG** – collection of Werner A Marggi (Thun, CH), **cMHG** – collection of Museum d histoire naturelle Geneve (CH), **cMLE** collection of Roman Mlejnek (Pardubice, CZ), **cJMO** – collection of Josef Moravec (Vrdy, CZ), **cPMO** collection of Pavel Moravec (Litoměřice, CZ) **cNBA** – collection of Naturhistorisches Museum Basel (CH), **cNMB** – collection of Naturhistorisches Museum Bern (CH), **cNMP** – collection of Narodni Muzeum Praha (CZ) **cPLU** – collection of Andrey Plutenko (Smolensk, RU), **cPRO** – collection of Jaroslav Prouza (Hradec Kralove, CZ) **cPUL** collection of Jan Pulpan (in collection of Vladimir Skoupy (Žilina u Kladna, CZ)), **cREJ** collection of Martin Rejzek (Praha, CZ), **cREB** – collection of Karel Rebl (Nove Strašeci, CZ), **cROL** collection of Jakub Rolčik (Praha, CZ), **cSCH** – collection of Jan Schneider (Praha, CZ), **cSCI** – collection of Riccardo Sciaky (Milano, I) **cSKO** collection of Vladimir Skoupy (Žilina u Kladna, CZ), **cSLZ** – collection of Tomaš Scholz (Ceske Budějovice, CZ), **cSMD** – collection of Staatliches Museum für Tierkunde Dresden (D) **cSME** – collection of Aleš Smetana (Ottawa CND), **cSMN** – collection of Staatliches Museum für Naturkunde Stuttgart (D), **cSTA** – collection of Jiří Stanovsky (Ostrava, CZ) **cSTO** – collection of Stobiecki (Institut Zoologii P A N Krakow, PL) **cSTR** – collection of Jaromir Strejček (Praha, CZ), **cTĚŤ** – collection of Ivo Těťal (Plzeň, CZ) **cVES** – collection of Petr Vesely (Praha, CZ), **cVON** – collection of Pavel Vonička (Liberec, CZ), **cWRA** – collection of David W Wrase (Berlin D), **cZIE** – collection of Vladimir Zieris (Pardubice, CZ) **cZMB** – collection of Moravske zemske museum Brno (CZ), **cZSM** – collection of Zoologische Staatssammlung Munchen (D), **cZUB** – collection of Miroslav Zuber (Kosmonosy, CZ), **cZVA** – collection of Bohdan Zvarič (Lovosice, CZ)

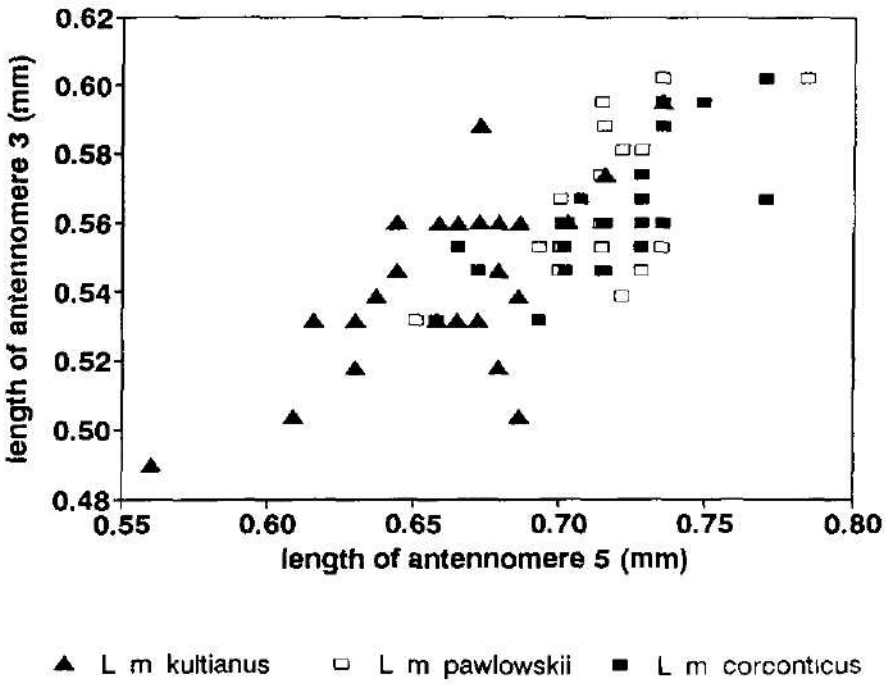


Fig 1 Antennal index length of antennomere 5/length of antennomere 3 (IA)

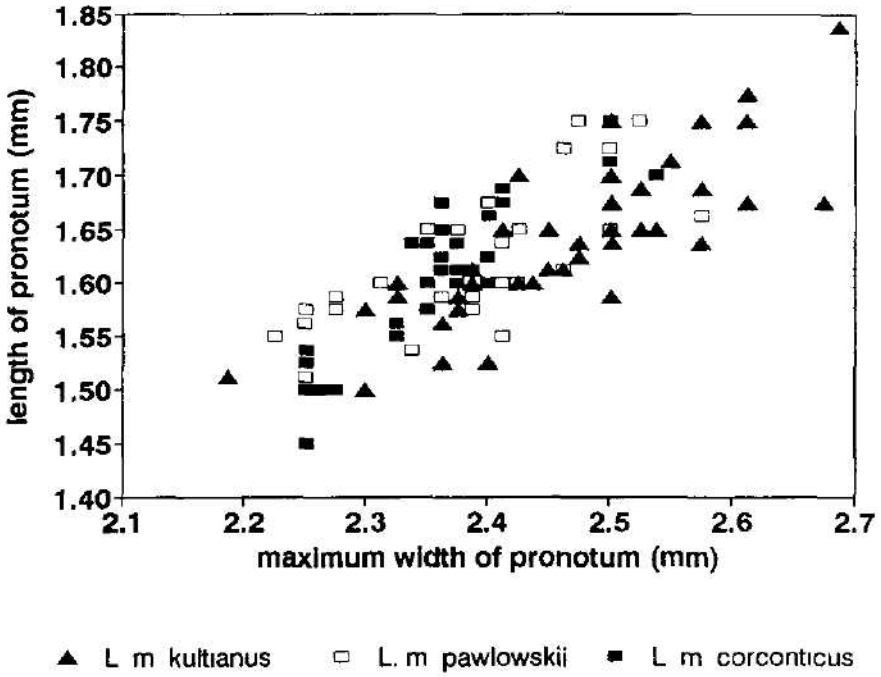


Fig. 2. Pronotal index: maximum width/length of pronotum (Ipw/l).

In the descriptions of the subspecies, we have used several indexes. They are listed below, including their abbreviations used in the text:

IA = antennal index: length of antennomere 5/length of antennomere 3 (Fig. 1),
Ipw/l = pronotal index: maximum width/length of pronotum (Fig. 2),
Ipm/b = pronotal index: two maximum width of pronotum/basal width of pronotum (Fig. 3),
IE/P = elytral-pronotal index: combined width of elytra/ maximum width of pronotum (Fig. 4),
Iel/w = elytral index: length/ combined width of elytra (Fig. 5).

For the establishment of the morphometric data and for calculations of the indexes mentioned above, 15 male and 15 female specimens were measured for *L. montanus corconticus* ssp. n. and *L. montanus pawlowskii* ssp. n., and 20 males and 20 females for *L. montanus kultianus* ssp. n.

Czech localities are followed, in square brackets, by a four-digit number of the cartographic field for the net-mapping of the fauna (Pruner & Míka 1996, see also Fig. 6). Slovak localities are according to the list of the localities and their codes for the net-mapping of the entomofauna of Czechoslovakia (Novak 1989, see also Fig. 6).

In the paragraph "Activity", the absolute numbers of males and females are given for each month of occurrence, as they were established from the locality labels of the specimens studied.

SYSTEMATIC PART

Our concept of *Leistus* (*Pogonophorus*) *montanus* Stephens, 1828 agrees with that of Perrault (1980, 1982, 1992). The species is distributed from Great Britain to Central Europe. Within this range,

it forms several more or less isolated groups of populations, which we characterize in the following text as subspecies.

Records of the occurrence and distribution of *Leistus montanus* in Europe are confusing due to the uncertainty in delimiting the two species *L. spinibarbis* and *L. montanus*, as well as to erroneous determinations in the past. Only after the positive delimitation of the two species by Perrault (1982), using the ratios of the maximal width of head (including eyes), of the width of the base of the pronotum and of the width of the base of the elytra, it became possible to positively evaluate the available records, and/or to revise doubtful material. At present, there is no doubt that *L. spinibarbis* does not occur on the territory of the Czech and Slovak Republics, since there are no reliable records available (e.g., Kult 1941: 16; 1947: 43; Hůrka 1996: 48–49).

Numerous authors document the occurrence of *L. montanus* on Czech lands, mostly from the screes of České středohoří Mts. (e. g., Veselý 1954: 420, Hůrka 1973: 24, 77, Strejček 1973: 57, Pulpán & Táborský 1983: 9, Vysoký 1984: 83, Vysoký 1989: 26, Benedikt & Těťál 1994: 16, Moravec 1995: 39, Veselý & Těťál 1998: 100). Other important Czech localities include Jince and Dobříš (Roubal 1926: 106), Praha-Hlubočepy (Pulpán 1957: 83), Praha-Řeporyje, Mareček lgt. (Benedikt & Těťál 1994: 16), Nehvizdy (e.g., Dvořák 1962: 4) [the locality was destroyed by buldozing]. Pičman (1979: 105) and Havelka (1985: 31) described the habitat as rocky screes in a quarry and confirmed the disappearance of the species due to the subsequent destruction of the habitat. Further records include the natural reserve Baba in Křivoklát area (Šmaha 1982: 141, 151), the castle Česká Kamenice in Česká Lípa area (Honců & Půlpán 1975: 103), and Stráž nad Ohří and Průčelská rokle (gorge) near Ústí nad Labem (Veselý & Těťál 1998: 100).

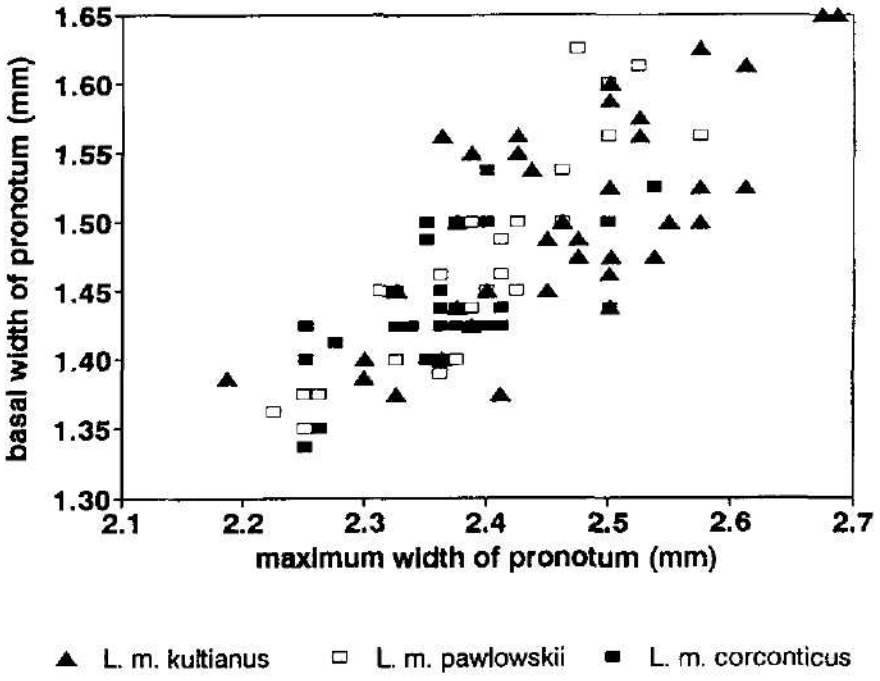


Fig. 3. Pronotal index two: maximum width of pronotum/basal width of pronotum (Ipm/b).

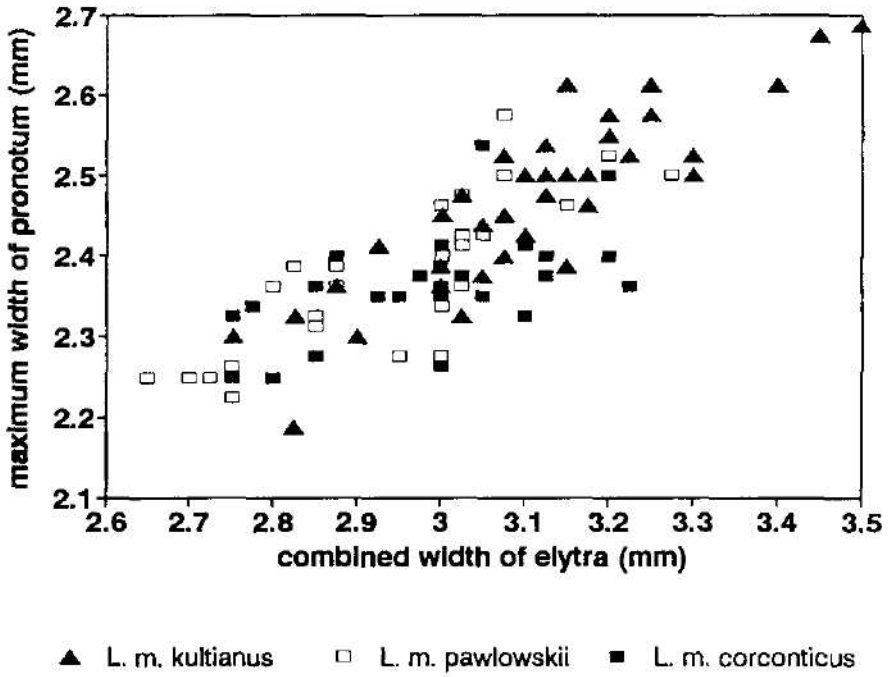


Fig. 4. Elytral-pronotal index: combined width of elytra/ maximum width of pronotum (IE/P).

Records from Krkonoše were published e.g., by Letzner (1871: 11), Leder (1872: 88), Letzner (1885–1891: 7) gives five localities (Koppenhegel, Teichränder, Vysoké Kolo, edges of Sněžné Jámy, Weigelstein), Schubert (1904: 15) records the species from Schwarze Koppe, Veselý (1954: 420), Pulpán (1957: 83) from Vysoké Kolo, Obenberger (1952: 182) repeats the occurrence on Vysoké Kolo and Sněžné Jámy, Noskiewitcz et al. (1961: 36) present records from Velký Šišák and Sněžné Jámy, and Martiš (1975: 120–121) and Pičman (1979: 105) from Vysoké Kolo. Hůrka (1958: 42) records it from Sněžka, Vysoké Kolo and Sněžné Jámy, Martiš (1972: 40) from Vysoké Kolo and from the vicinity of Labská bouda. Benedikt & Těťál (1994: 16) from the vicinity of Sněžné Jámy, and Veselý & Těťál (1998: 100) from Vysoké Kolo. Dvořák (1962: 4) mentions the occurrence in Krkonoše without giving any details. Koltze (1873: 209, 210) published two lokalities: Brünnenberge and Koppenplan.

Letzner (1871: 12) records *L. montanus* from the subalpine, treeless ridges of Praděd and Králický Sněžník.

The record from the Olomouc area, published by Hudeček (1930: 372) is obviously a misidentification of *L. rufomarginatus* Duftschmid, 1812.

The occurrence of *L. montanus* in Babia Góra was published by Riehn (1914: 407), Makólski (1952: 215) (material from the collection Maczyński) and Pawlowski (1967: 497). Burakowski et al. (1973: 67–68) summarize the published historical records on the territory of Poland (Sudety Zachodnie: Karkonosze, Beskid Zachodni: Babia Góra, Tatry (Żółta Turnia, Śląsk, Sudety)). Razowski (1991: 8) confirms the occurrence of *L. montanus* in Poland, without giving any details.

The occurrence of *L. montanus* in Slovakia is mentioned by Pulpán & Hůrka (1993: 13) without presenting any records; however, Hůrka (1996: 50–51) records the species from Slovakia only tentatively.

The differentiation of the populations from Krkonoše and České středohoří Mts. is mentioned in the paper by Hůrka (1996: 48–51), in which Hůrka also offers reliable diagnostic characters of these two allopatric taxa.

Members of the taxon *L. montanus* have quite specific habitat requirements (petrophily, strict microclimatic conditions in habitats) and consequently their ability to migrate is limited. Based on this situation, it is possible to subdivide the populations of *L. montanus* into five subspecies, three of which are erected as new in this paper.

This is also supported by the findings of Veselý (1952: 420), who in his paper postulates probable evolution and distribution of the species of Hercynian origin, that before glaciation were able to spread over large areas. Subsequently, after the glacials, they proceeded to evolve in isolated groups of populations. Atlanto-hercynian origin of *L. montanus* is also postulated by Pulpán (1968: 122).

Bionomical and chorological data concerning *L. montanus* in Central Europe may be found e.g., in papers of Assmann (1993), Dvořák (1992), Horion (1941), Horvatovich (1971), Koch (1989), Lindroth (1974), Marggi (1992) and Obenberger (1952).

The recent distributional ranges of the newly erected subspecies are shown on Fig. 6.

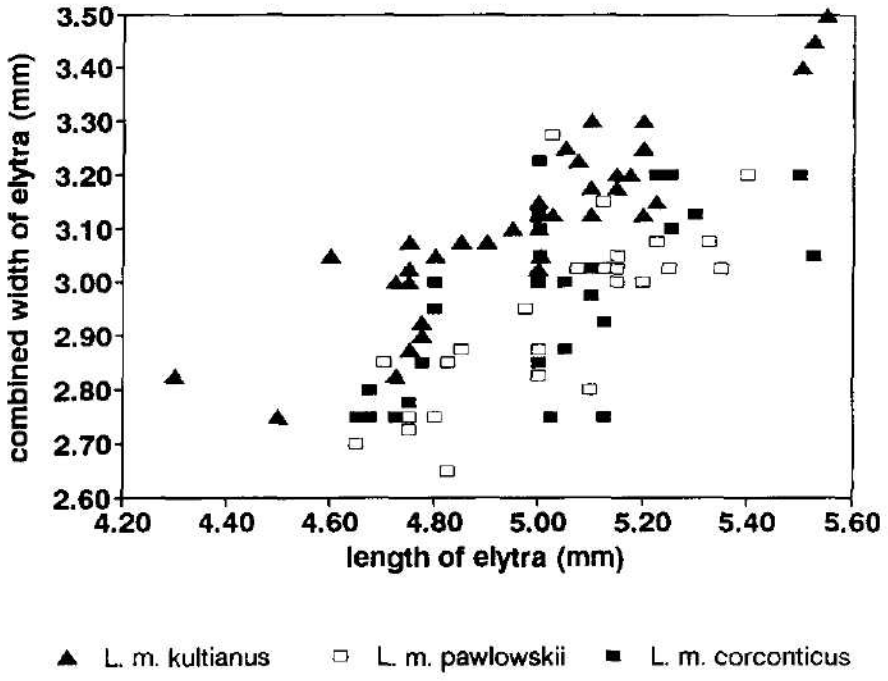


Fig. 5 Elytral index length/ combined width of elytra (Icl/w)

Leistus (*Pogonophorus*) *montanus montanus* Stephens, 1828

Leistus montanus Stephens, 1828 64

MATERIAL EXAMINED 1 female, labelled Power 96-69, ex collectio BMNH [British Museum of Natural History] London, det & cum typo comparatum M Fassati, 1977, cFSS, 5 males, labelled Catacol Arrau, 22 IX [19]23 ex collectio BMNH London, det & cum typo comparatum M Fassati, 1977, cFSS, cf AR, 1 female, same data, but 19 IX [19]22, Fergusson [leg], cFSS

DISTRIBUTION Locus typicus "Schottland" Great Britain, France, W Switzerland, N Spain (Jeanne 1973 13, Marggi 1992 58)

Leistus (*Pogonophorus*) *montanus rhaeticus* Heer, 1837

Leistus rhaeticus Heer 1837 16
Leistus montanus var *rhaeticus* Horion, 1941 69, Csiki, 1946 161
Leistus montanus rhaeticus Reitter, 1925 333, Mrozek-Dahl, 1928 36, Burmeister, 1939, Marggi, 1992 57

MATERIAL EXAMINED 1 specimen, labelled Steineter Jahl, 11 VII [19]40/Umg Innsbruck Ti Pechlaner/ *Leistus montanus* /Staatssig Munchen/ Cum Typo comparatum [in ETH Zurich] M Fassati, 1983/ *Leistus montanus rhaeticus* Heer, 1840, cZSM, 1 male, labelled D, Rhlnd Ahrtal, 15 V [19]51, J Klapperich leg , cSMN, 1 female, labelled Helvetia, Mattmark Wallis, 12 VII 1976, Sonderegger leg , cMGG, 1 specimen, labelled Mt Moro (VS), cNMB, 4 specimens, labelled Biel (BE), cNMB 1 male, labelled Insbruck, cFSS, 1 female, labelled Nordtirol Alpen, Breit [leg], cFSS, 1 male, labelled Insbruck Umg , Breit [leg], cFSS, 1 female, labelled Greif, cFSS, 2 females, labelled Bienne, 12 IV [19]16, A Mathey [leg], cFSS, 1 male, same data, but 22 IV [19]16, cFSS, 2 females, labelled Brenner, cf SS, 1 male, same data, det & cum typo comparatum M Fassati, 1983, cFSS, 1 male, labelled Schweiz, D Koltze [leg], cFSS 1 male, 1 female, labelled Helvetia, Jura, cFSS, 1 female, labelled Jura, cFSS, 2 males, labelled Schweiz, Bienne (Biel), cFAR, cFSS

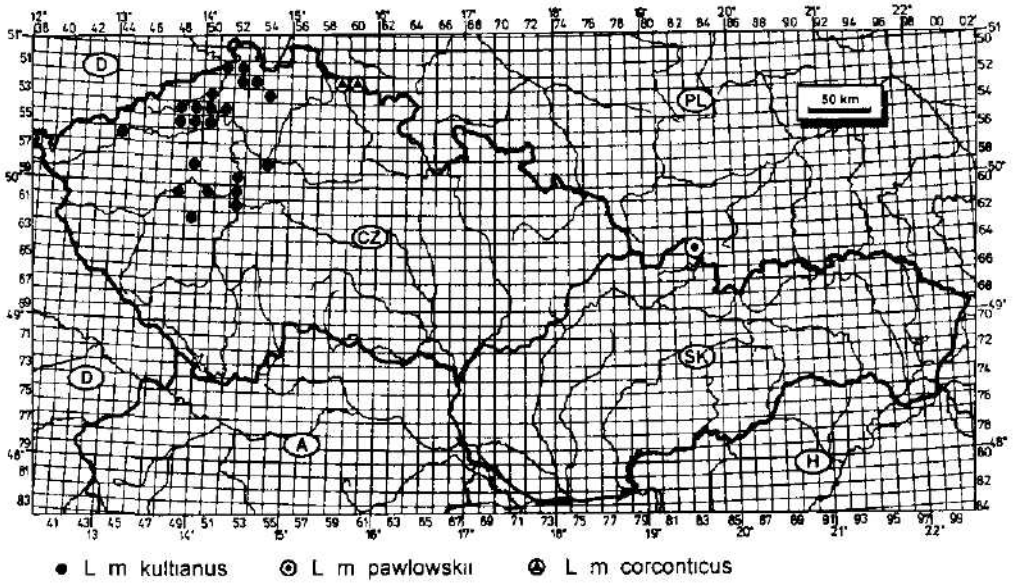


Fig 6 Distribution of *Leistus* (*Pogonophorus*) *montanus kultianus* ssp n (dod), *L* (*P*) *m pawlowskii* ssp n (dot in circle) and *L* (*P*) *m corconticus* ssp n (triangle in circle) in Central Europe

DISTRIBUTION Locus typicus "Camogascerthal" The Alps (France, Switzerland, Italy, Yugoslavia) (Marggi 1992 58, Vigna Taglianti 1993 7)

Leistus (Pogonophorus) montanus corconticus ssp. n.
(Figs 7, 10–11, 16–17)

DESCRIPTION (habitus of holotype and allotype as in Figs 16–17) Body length 7 7–9.1 mm (mean 8 48 mm), holotype 8 3 mm, allotype 9 0 mm, males 7 7–8 7 mm (mean 8 31 mm), females 8 1–9 1 mm (mean 8 63 mm) Blue to greenish-blue, rarely brownish-blue, shiny Ventral surface piceous-black Lateral bead of pronotum and elytra and epipleura brownish Mandibles, maxillary appendages, antennae and entire legs brownish-yellow to yellow Head with prominent eyes, area between eyes with very fine, evanescent punctation IA = 1 20–1 38 (mean 1 26)

Pronotum (Fig 7) markedly cordiform (IPm/b = 1 56–1 74 (mean 1 66)), lateral bead evenly wide, flattened, lateral margin only slightly sinuate in front of posterior angles Posterior pronotal angles obtusely angulate Punctures on middle of pronotal disc small, fine Anteromedial triangular depression and basal impression both with coarse and large punctures IPw/l = 1 41–1 55 (mean 1 47)

Elytra (Fig 7) almost parallel-sided (IEl/w = 1 55–1 86 (mean 1 68)), with humeral tooth Punctation of elytral striae finer, but distinct Macropterous, wings 1 14–1 23 x as wide as elytral width Scutellar setiferous punctures 1+1, dorsal setiferous punctures 1–5 IE/P = 1 18–1 37 (mean 1 26)

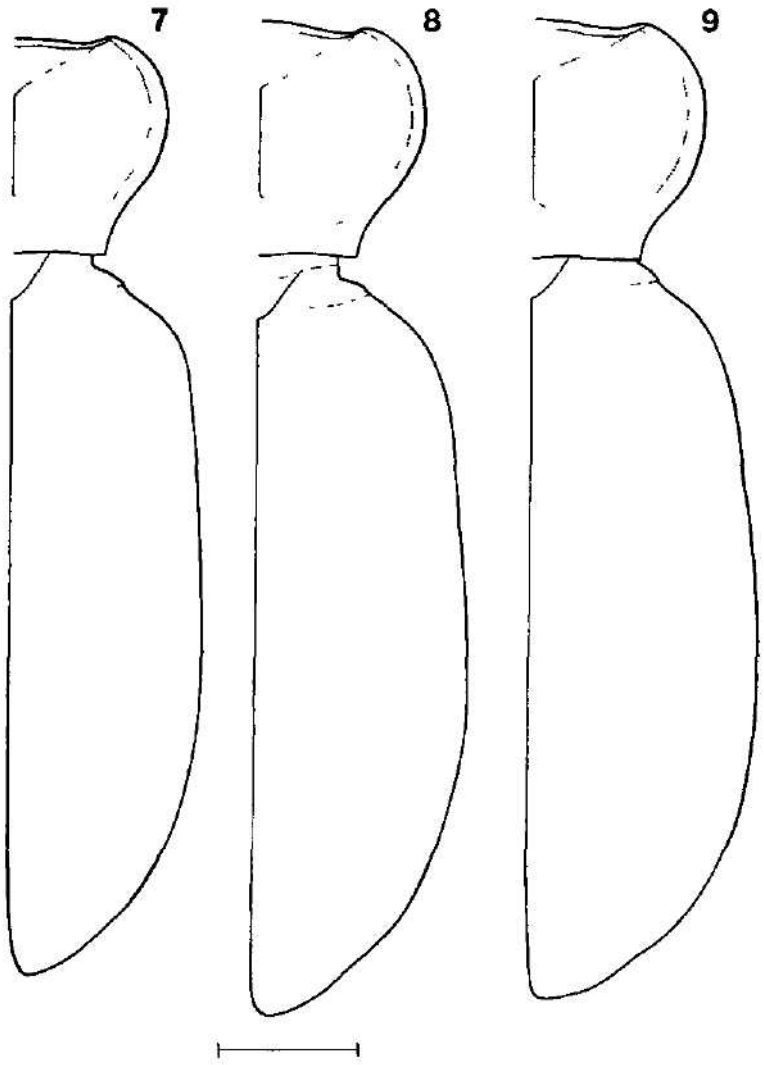
Aedeagus (Figs 10–11) with apical portion obliquely truncate, actual apex prominent

AFFINITIES Differential diagnosis may be found in the key The two new subspecies from the Czech Republic may be distinguished also by the characters given by Hůrka (1996 50–51) The differences in the shapes of the pronota, elytra and of the aedoeagi of the two subspecies are shown by Figs 7–8, 10–13

TYPE MATERIAL **Holotype** Male, labelled Bohemia sept , Krkonoše [Mts], Vysoke kolo [Mt], 1480 m, 11 IX 1945 M Fassati lgt , cFSS **Allotype** Female, same data as holotype, but 1485 m, cFSS **Paratypes** One hundred-six specimens Localities in the Czech Republic 2 males, labelled Bohemia sept , Krkonoše, Vysoke kolo, 1480 m, 11 IX 1945, M Fassati leg , cFSS, 1 male, same data, but 23 VIII 1956, cFSS, 1 female, same data, but *1490 m, 11 V 1954*, cFSS *1 male, same data, but 1503 m, 27 VIII 1957*, cFSS, *1 male, 1 female, labelled Krkonoše*, Vysoke kolo cFSS, 1 male, labelled Bohemia or , Krkonoše, Vysoke kolo, 17 VII 1953, J Půlpán leg , cPUL, 1 male, same data, but VII 1962, Žirovnicky leg cPUL, 1 female, labelled Bohemia or , Krkonoše, Vysoke kolo, 17 VII 1957, Reška leg , cPUL, 1 specimen, labelled Riesengeb[irge] G S Juni [19]67/ Collection v Seidlitz/ Staatssig Munchen/ *Leistus montanus* ssp *corconticus* det M Fassati 1985, cZSM, 13 males, 17 females labelled Boh[emia] bor or , [5259], Krkonoše, Vysoke kolo, 1470–1500 m, 13 IX 1987, R Mlejnek lgt , cFAR, cFSS, cMLE, cPUL cSKO cWRA, 4 males and 1 female, labelled Bohemia or , Krkonoše, Vysoké kolo, 17 IX 1987, V Zieris lgt , cFAR, cZIE, 1 male, 1 female, same data, but 22 IX 1987, cPMO, cPUL, 1 male, same data, but 22 IX [19]87, cPRO, 1 male, 1 female, same data, but 13 IX 1987, Z Klouček lgt , cGEB, cPMO, 1 male, 1 female, labelled Boh[emia] b , [Krkonoše], Vysoke kolo, 1506 m, 17 VII 1957, [Z] Likovsky lgt , cHON, 1 male, same data, but 15 VII 1963, 1503 m, cHON, 2 males, 1 female, labelled ČSSR Boh or [5259] Krkonoše Vysoke kolo 1470–1500 m 6 IX 1987, R Mlejnek lgt , cKAŠ, cLIN, 1 male, labelled ČSSR Bohemia b or , Krkonoše, Vysoke Kolo, 9 VIII [19]87, J Klouček lgt , cKAŠ, 2 females, labelled Bohemia bor -or , Krkonoše, Vysoke kolo 13 IX 1987, J Klouček lgt , cKAŠ, cSCH, 1 female, labelled Boh[emia], Krkonoše, Vysoke kolo, 19 IX 1995, lgt [T] Kopecky, cZIE, 1 male, 1 female, labelled Krkonoše, Vysoke kolo [J] Mařan lgt , cNMP, 1 male, 2 females, labelled Bohemia bor Krkonoše, Vysoke kolo, 10 V [1]952, O Kavan leg , cFAR, 1 male, 1 female, labelled Krkonoše Vysoke kolo, 11 VIII [19]78, [J] Prouza [lgt], cBUL, cPRO, 2 females, same data, but 17 IX [19]87 cPRO, cTĚŤ, 1 male, 1 female, same data, but 20 VIII [19]91, cFAR, cPRO, 8 males, 6 females, labelled Boh bor or Vysoke kolo 1470 1500 m, 22 VIII –13 IX 1987, R Mlejnek leg , cJMO, cSMF, 1 male, labelled Krkonoše 6 IX 1987, leg Mlejnek cCHV, 1 male, 1 female, labelled Bohemia or , Krkonoše, Vysoke kolo 13 IX 1987, Klouček leg , cMAR, cZUB 1 female, labelled Bohemia, Krkonoše, Labska, 15 VII [19]62, Žirovnicky lgt , cFAR 1 male, labelled Boh[emia] b , Krkonoše, Studnična, VI 1957, V Vosyka lgt , cZIE, 1 male, 1 female labelled Boh[emia], Krkonoše, Sněžka, 1600 m, [K] Hůrka lgt , cHŮR, 1 female, labelled Krkonoše, 16 VII [19]62 Labska bouda, J Doutnač [lgt], cFAR, 1 male, 1 female, labelled Boh b , Krkonoše, VII [19]62, Labská bouda, [J]

Doutnáč [lgt], cGTT, 1 female, same data, but Vysoke kolo, cGTT, 2 females, labelled Boh[emia] bor Krkonoše Mts , Vysoke kolo, 1605 m, 15 vii 1995, J Háva lgt , cHÁV, 1 male, 1 female, Riesengeb [irge], [without precise data], collectio V Zoufal, Moravske museum Brno, cZMB, Localities in Poland 1 male, labelled Polska, Smežne Jamy, 16 vii [19]62, J Doutnáč [lgt], cFAR, 1 female, same data, but 17 vii [19]62, cFSS, 1 male, same data, but 19 vii [19]62, cFSS, 1 female, labelled Poland, Vysoke kolo, 29 vii 1980, P Bulirsch leg , cBUL

ETYMOLOGY The subspecific epithet is derived from the Latin name of the Krkonoše, the highest mountain range in Bohemia (and the Czech Republic), in which the new subspecies occurs



Figs 7–9 Outlines of pronota and elytra of 7 – *Leistus* (*Pogonophorus*) *montanus corconticus* ssp n , 8 – *L* (*P*) *m kultuanus* ssp n , 9 – *L* (*P*) *m pawlowskii* ssp n Scale 1 mm

DISTRIBUTION (Fig. 6). Bohemia: Krkonoše [Mt.] (Labská, Sněžka, Studničná, Vysoké kolo) [5259]; Polonia: Krkonoše [Mt.] (Sniežne jamy). Very rare and localized, in screes of the alpine zone.
ACTIVITY. May (1/3), June (2/0), July (6/11), August (5/2), September (27/27).

Leistus (Pogonophorus) montanus kultianus ssp. n.
(Figs 8, 12–13, 18–19)

DESCRIPTION (habitus of holotype and allotype as in Figs 18–19). Body length 7.3–9.2 mm (mean 8.40 mm), holotype 8.5 mm, allotype 8.4 mm, males 7.5–8.6 mm (mean 8.19 mm), females 7.3–9.2 mm (mean 8.51 mm). Blue, greenish-blue, rarely purplish, shiny. Ventral side piceous-black. Lateral bead of pronotum and elytra and epipleura brownish, yellowish-brown, or brownish-red. Mandibles, maxillary appendages, antennae and entire legs browhish-yellow. Head with prominent eyes, area between eyes with distinct punctation. IA = 1.14–1.36 (mean 1.22).

Pronotum (Fig. 8) cordiform, lateral bead evenly wide, flattened, lateral margin emarginate in front of posterior angles. Posterior angles acutely angulate to almost rectangular. Punctures on middle of pronotal disc small, coarser, more distinct. Anteromedial triangular depression and basal impression with large, coarse punctures. IPw/l = 1.43–1.60 (mean 1.50), IPm/b = 1.51–1.75 (mean 1.64).

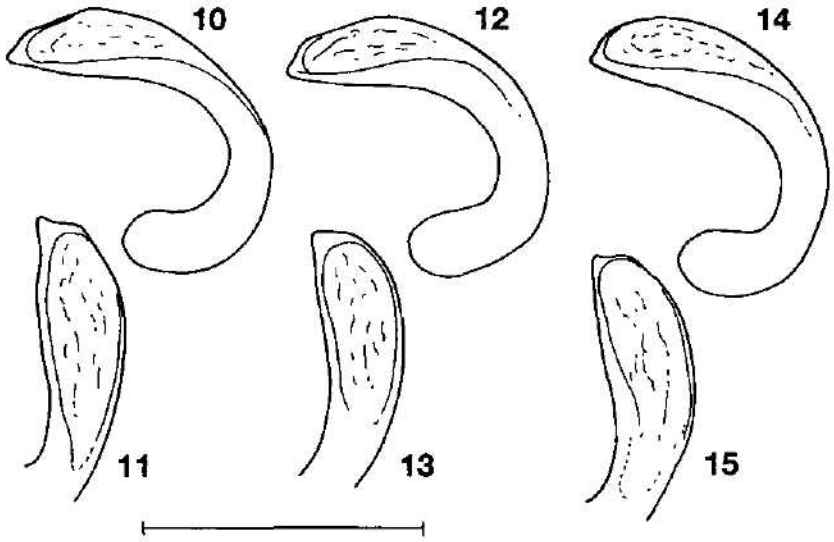
Elytra (Fig. 8) with lateral margins slightly convex, widest behind middle (IEl/w = 1.51 –1.67 (mean 1.60)), with humeral tooth. Punctation of elytral striae coarser and distinctive. Macropterous, wings 1.25–1.36 as long as elytral width. Scutellar setiferous punctures 1+1, dorsal setiferous punctures 1–5. IE/P = 1.20–1.32 (mean 1.26).

Aedeagus (Figs 12–13) with apex obliquely truncate.

AFFINITIES. Differential diagnosis may be found in the key. The two new subspecies from the Czech Republic may be distinguished also by the characters given by Hůrka (1996: 50–51). The differences in the shapes of the pronota, elytra and of the aedoeagi of the two subspecies are shown by Figs 7–8, 10–13.

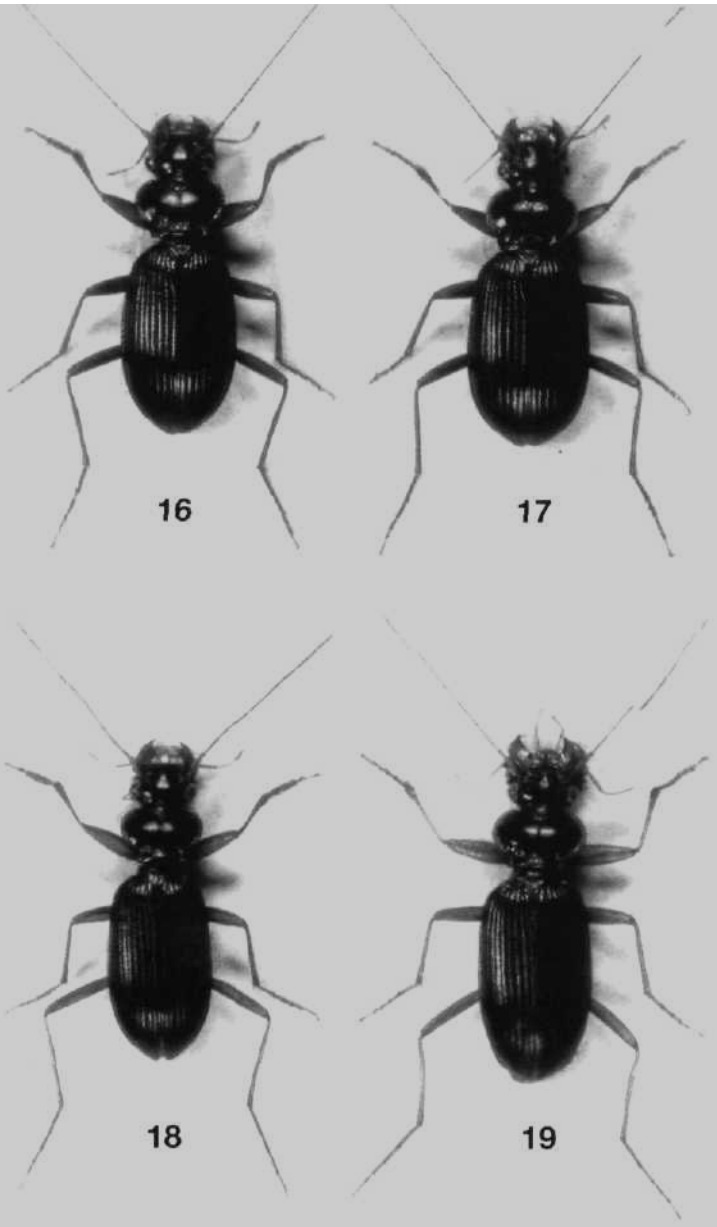
TYPE MATERIAL **Holotype**. Male, labelled: Bohemia sept., České Středohoří, Raná u Loun, 400 m, 18.iv 1965, north slope, deep in the scree, rainy weather, M. Fassati lgt., cFSS. **Allotype**: Female, same data as holotype, cFSS **Paratypes** Seven hundred-thirty nine specimens Localities in Czech Republic Blešenský vrch 1 male, 1 female, labelled: Bohemia, České Středohoří, Blešenský v[rch], 14.ix.1993, P. Moravec leg., cPMO Boreč: *1 male, labelled Bohemia, České středohoří, vrch Boreč, 24.iv.1957, leg. J. Strejček, cSTR; 2 males, same data,* but 8.x.1959, cPUL, cSTR, 1 male, labelled Bohemia sept., České středohoří, Boreč, iv.1958, M. Fassati leg., cFSS, 1 male, labelled: Bohemia, České středohoří, Boreč, ix.1967, J. Pulpán leg., cPUL, 1 female, labelled Boh[emia], Č[eské] Středohoří, Boreč, 24.v.1973, [M.] Honců lgt., cFAR; 2 males, labelled: CS –Bohemia b., České Středohoří, Boreč, 1.v 1991, P. Bulirsch lgt., cBUL, 3 males, 2 females, same data, but M. Linhart lgt., cLIN; 1 male, 1 female, labelled: Bohemia bor., České středohoří, vrch Boreč, 22.v 1993, cJAR, 1 female, labelled Bohemia, České středohoří, v. Boreč, 1.viii.1981, P. Moravec leg., cPMO; 1 male, same data, but 1.v 1991, P. Moravec leg., cPMO; 2 males, 1 female, same data, but 30.viii.1993, cPMO; 1 male, labelled: Bohemia, Ceske *středohoří, Boreč, 1.v 1991, I. Mareček leg., cMAR; 2 males, 2 females, same data, but 1.v.1995, cMAR, 1 male,* 4 females, same data, but 29.viii 1996, cMAR; 4 females, same data, but 31.viii 1996, cMAR, 1 female, labelled Bohemia b., Č[eské] středohoří, v. Boreč, 4.ix 1993, M. Jaroš leg., cKLI; 5 males, 4 females, labelled Boh[emia] bor., Boreč u Lovosic, 29.ix.1998, M. Kovařík lgt., cHÁV, cKOV Bořeň 5 males, 7 females, labelled: Bohemia, České středohoří, Bořeň, 31.v 1994, P. Moravec lgt., cPMO; 2 males, same data, but 27.ix 1994, cPMO; 3 males, 3 females, labelled Bohemia bor., Bořeň [5448], 16.ix 1995, J. Farkač leg., cFAR Brdy 1 male, labelled Bohemia, Brdy, Jordan, 30.ix –14.x.1995, leg. O. Hovorka, cHOV Brná: 2 males, 4 females, labelled: Bohemia sept., Brná n. Labem, 17.vi 1978, M. Antuš leg., cFAR, cDVO; 1 male, 1 female, labelled: Bohemia bor., České *středohoří, Brná, Průčelská rokle, 3.ix.1993, cJAR;* 4 males, 3 females, labelled: Bohemia, České Středohoří, Brná, v 1994, M. Hackel lgt., cFAR, cKAB; 1 female, labelled: Bohemia bor., Brná n. Labem, Průčelská rokle, 17.v 1994, P. Bulirsch lgt., cLIN, 8 males, 2 females, same data, but 24.ix 1995, M. Linhart lgt, cLIN; 10 males, 4 females, labelled Bohemia, **Brná, Průčelská rokle**, 29.ix.1995, I. Mareček leg., cMAR; 5 males, 5 females, same

data, but 25 v 1996, cLIN, 7 males, 2 females, labelled Bohemia, Brná n Lab. env, 10 x 1998, J. Jurčíček lgt, cJUR, 1 male, 1 female, same data, but M. Kovařík lgt, cKOV, 21 males, 6 females, same data, but 17.x.1998, cJUR, 11 males, 5 females, same data, but M. Kovařík lgt., cHÁV, cKOV, cPLU, cROL. Čertova jizba. 5 males, 3 females, labelled: Bohemia, České středohoří, vrch Čertova jizba (5350), 8 x 1999, P Moravec lgt., cPMO Česká Kamenice 1 female, labelled České středohoří, Česká Kamenice, Zámecký v[rch], 3.x.1995, P Moravec leg, cPMO, 1 female, labelled· Bohemia bor., Lužické hory mts, v Studenec nr. Č[eská] Kamenice, 10.v–2t vi.1998, J Růžička leg, baited pitfall trap No 4 (fish meat, ripe cheese), scree on southern slope, bottom edge, cPMO. Davle 1 female, labelled [Bohemia], Davle, Březová, 4 vi [?], Zeman [leg], cFSS Hazmburk 1 female, labelled Bohemia bor, České Středohoří, Hazmburk, [?] 1946, Josef Král leg, cKRÁ. Jílové 1 female, labelled Bohemia cent., Jílové u Pr[ahy], 7 ix 1952, O Kavan leg., cFAR Kletečná· 1 female, labelled. Bohemia bor., České Středohoří, Kletečná mts., 23.ix 1989, Jan Farkač leg, cFAR. Klíč. 19 males, 10 females, labelled [Bohemia] Klíč u Nového Boru, 22 ix 1996, M Honců lgt., cHON, cFAR, 1 female, labelled ČSSR Bohemia b., Nový Bor, Klíč, 10 x 1982, [R] Marschner lgt, cKAŠ; 1 male, labelled· Bohemia b., Klíč, 16.x. 1983, [R.] Marschner leg., cCHV. Lány: 1 male, 2 females, labelled CS-Bohemia c, Lány, iv.1984, K Rébl lgt, cRÉB, cFAR. Nehvizdy. 1 male, 2 females, labelled· Boh[emia], Nehvizdy, 11.x.1958, [Z] Likovský lgt., cHON, cFAR; 1 female, same data, but 22.ix.1957, cHON; 1 female, labelled. ČSR, Nehvizdy, ix.[19]37, J. Král leg., det. K Kult as *Leistus montanus rhaeticus* Heer, cFSS, 1 male, labelled· Boh[emia], Nehvizdy, 6.iv.1941, leg. K. Kult, det. Bänninger in 1943 as [*Leistus*] *montanus*, cFAR; 1 female, labelled Bohemia cent., Nehvizdy, 11.ix.1952, O. Kavan leg, cFAR; 1 male, same data, but 27 ix 1956, B Štícha [leg], cFAR, 1 male, 1 female, same data, but 7 x 1955, M. Dvořák [leg.], cFAR, cGTT; 1 female, same data, but 22 ix [19]46, Věž leg., cFAR; 1 male, 1 female, same data, but 1 x 1945, M Fassati leg, cFSS; 1 female, same data, but iv 1937, K Kult leg., Dr. [J] Mařan det. as *Leistus montanus rhaeticus* Heer, cFSS; 1 male, labelled: Bohemia, Nehvizdy, 13.x 1956, leg. Reška, cPUL, 1 male, same data, but 8 x 1958, cPUL; 1 male, 2 females, labelled Bohemia c, Nehvizdy, 28 x 1961, leg. M Dvořák, cDVO Oblík: 2 males, labelled· Bohemia, Oblík u Loun, 23 iv.1977, D. Král lgt, cKRÁ; 1 male, 2 females, labelled Boh[emia], Louny env, Oblík, 25 ix 1983, J Farkač leg, cFAR, 1 female, labelled. Bohemia b., Raná, vrch Oblík, v [19]77, Rébl lgt, cRÉB; 1 male, 1 female, labelled Bohemia bor., České středohoří, vrch Oblík, 25 x 1998, cJAR; 2 males, labelled Bohemia, České středohoří, vrch Oblík (5548), 5.x.1999, P Moravec lgt., cPMO Ovčín 1 male, 1 female, labelled· Bohemia bor, České středohoří, vrch Ovčín, 13.ix 1993, cJAR; 2 males, labelled Bohemia, České Středohoří, v Ovčín, 13 ix 1993, P. Moravec leg, cPMO Plešivec 4 males, 4 females, labelled: Boh[emia], Plešivec, 2 ix.1971, M. Honců lgt, cHON, cFAR; 1 male, 1 female, labelled· Bohemia bor., České středohoří, vrch Plešivec, 1 x.1994, cJAR, 1 male, labelled České středohoří, v Plešivce prope Litoměřice, 1.ix.1993, P Moravec leg., cPMO, 2 males, same data, but



Figs 10–15 Aedeagi in dorsal and lateral view of holotypes of: 10, 11 – *Leistus* (*Pogonophorus*) *montanus corconticus* ssp. n; 12, 13 – *L* (*P*) *m. kultianus* ssp n, 14, 15 – *L.* (*P*) *m pawlowskii* ssp. n. Scale 1 mm.

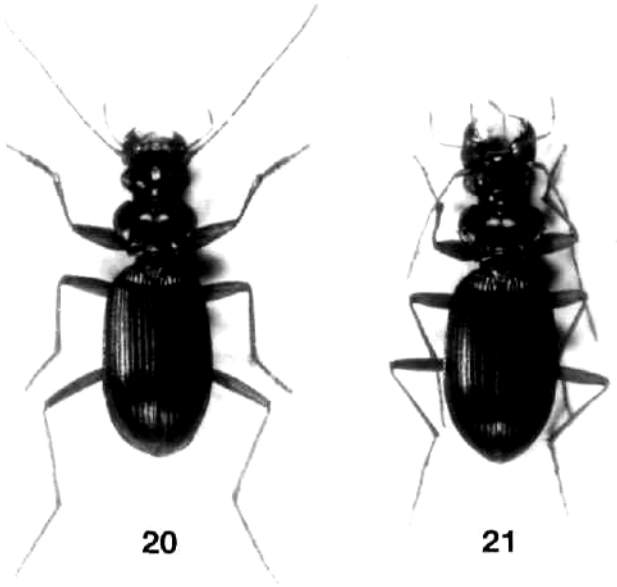
2 ix 1993 J Růžička lgt , cPMO Praha-Hlubočepy· 1 male, labelled Bohemia centr , Praha-Hlubočepy, 1 x 1939, J Půlpán leg , cPUL Praha-Řeporyje 1 male, labelled Bohemia centr , Praha-Řeporyje, 16.iii 1991, I Mareček leg , det. as *Leistus montanus montanus* Stephens,1827, det I Mareček,1995, cMAR Ralsko. 9 males, 11 females, labelled Boh[emia] Ralsko, 6 x.1996, [M] Honců lgt , cHON, cFAR, 1 female, labelled Bohemia, Ralsko, 3 vii [19]85, cFAR, 1 male, labelled· Bohemia, Ralsko, 15.vi 1985, leg J Chvalkovský, cCHV, 1 male, *same data, but 27 v 1986, cCHV, 11 males, 21 females, same data, but 3 vii 1997, cCHV, cFAR; 16 males,* 19 females, labelled. Bohemia bor , vrch Ralsko [5354], 15 vi 1994, P Kučera lgt , cKUČ, cVON; 1 female, same data, but 11 ix 1984, R. Beran lgt , cBER, 2 females, same data, but 28 v 1994, cBER Raná· 3 males, 2 females, labelled Bohemia, České středohoří, Raná, 25.iv.1964, Reška leg , cPUL; 5 males, 5 females, labelled Bohemia sept , České středohoří, Raná u Loun, 400 m, 18.iv.1965, M. Fassati leg, cFSS, cNMP; 1 male, same data, but *Leistus montanus kultianus* m det M Fassati, 1985, cZSM, 6 males, 3 females, labelled. Bohemia, České středohoří, Raná, 18.iv 1965, J. Pulpán leg., cPUL, 1 female, same data, but iv 1966, cPUL, 2 males, 1 female, same data, but 12.x.1966, cZMB, 24 males, 14 females, same data, cPUL; 1 male, 1 female, same data, but v 1967, cPUL, 2 males, 1 female, Bohemia sept , České Středohoří, Raná, 23 iv.1967, M Fassati leg , cFSS; 1 male, 1 female, same data, but 27.iv.1968, cHEJ; 1 male, 1 female, labelled. Boh[emia], Louny env , Raná, 25.ix.1983, J Farkač leg , cFAR, cČER; 1 male, same data, but 12 ix 1995, cFAR, 1 male, same data, but 9.ix 1997, cFAR, 2 males, 1 female, labelled Boh[emia] bor , Raná, Č[eské] Středohoří, 1 xi.1972, M Honců lgt , cHON; 1 male, 1 female, same data, but 20 x.1971, cHON; 1 male, same data, but 22 ix 1971, cHON, 1 male, labelled: Bohemia, vrch Rana, 30 iv.1972, leg. J Strejček, cSTR, 1 male, labelled: Bohemia, Raná nr. Louny, x 1969, leg. V Skoupý, cSKO; 1 male, same data, but 15 v 1982, cSKO; 1 male, labelled. Bohemia, Raná, 16 v.1982, leg. [V.] Skoupý, cMHG, 2 males, 8 females, same data, but 25.ix.1981, leg Trávníček, cHEJ, cSKO, 1 female, same data, but 20 vi 1981, cPUL, 2 males, 3 females, labelled Bohemia, Raná u Loun, 23 iv.1977, D. Král lgt., cKRÁ, 1 male, labelled Bohemia, České středohoří, Louny – Raná, 28.ix.1980, [T.] Scholz leg., cPUL; 6 males, 6 females, same data, cSLZ, 1 male, 2 females, same data but 23 x 1977, cSLZ, 3 females, labelled· CS-Bohemia occ., Raná, *16 v 1982, [K] Rébl lgt , cHÁV, cKAŠ, cWRA; 1 specimen, labelled: Bohemia, Louny – Raná, P Krásenský lgt.,* cLAK, 1 male, same data, but 24.x.1993, cFAR; 2 specimens, labelled. Bohemia, Raná, 25 ix 1981, Z. Trávníček lgt., cLAK; 1 male, 1 female, same data, cZVA; 1 male, labelled: Bohemia, České středohoří – vrch Raná, 9 v 1984, P Veselý leg., cVES; 1 male, same data, but 27.ix.1990, cVES [a copulating pair on a rock in the scree on a sunny morning, the female escaped]; 2 males, 3 females, same data, but 13 vi 1995, cVES [in scree after rain]; 7 males, 5 females, same data, but 13 –14 vi.1995, cVES [resting during the night, 23 00–0.30 am, on rocks in scree after rains, temperature 9°C, 100% relative humidity (Veselý & Těťál, 1998)]; 1 male, 1 female, labelled. Boh[emia] bor , Raná, 25 v 1985 Šilha lgt , cMGG, cWRA, 1 female, labelled Bohemia, Raná, 14 iv 1984, Petr Ričl leg , cJAN, 2 males, 1 female, labelled Boh[emia], České Střed., Raná, 25 ix 1985, [P.] Bulirsch leg., cBUL, 2 males, same data, but 24 iv 1983, cWRA; 2 males, 1 female, labelled: CS-Bohemia occ., Raná, vrch Raná, 16 v 1982, [K] Rébl lgt , cRÉB, 1 male, same data, but v 1984, cPRO, 1 female, labelled. Boh[emia] bor , Raná, 26 v [19]82, R. Wachtl lgt , cPRO, 1 female, same data, but iv. [19]83, cJAN; 1 female, same data, but v.[19]84, cJAN; 5 males, 6 females, labelled: Boh[emia] centr , Raná – ssutě, 4 v.1963, [K] Hůrka lgt , cHŮR; 1 female, same data, but Rana severových[od], 29 v.[19]62, cHŮR; 3 males, 2 females, labelled. Bohemia b. oc , Lenešice – Raná, 20.ix [19]86, [J] Prouza leg , cPRO, cPUL; 2 males, 1 female, labelled Bohemia b , Raná, 28.viii.1994, leg Moravec, cCHV; 1 male, 1 female, labelled Bohemia b Raná, 6.iv 1995, leg [P] Krásenský, cCHV; 1 male, 1 female, labelled· Bohemia bor , České středohoří, vrch Raná, 28.x 1992, cJAR; 6 males, 4 females, labelled: Bohemia, České středohoří, Raná, 2 ix 1993, O Hovorka leg , cHOV; 1 female, labelled: Bohemia b , Raná, 25 ix.1985, Z Trávníček leg., cMKA, 2 females, labelled Bohemia, České středohoří, v Raná, 15.vi.1975 J Hejkal leg , cHEJ, *cPMO; 1 female, same data, but 6.–15 vi [19]75, cZVA; 2 males, 4 females, same data, but 28.x.1992, P Moravec* leg , cPMO; 2 males, same data, but 4.ix 1993, cPMO, 1 female, same data, but 14 ix.1993, cPMO, 1 male, labelled: Bohemia bor , Raná u Loun, 28 x 1990, M. Linhart lgt., cLIN; 1 female, labelled Bohemia, České středohoří, vrch Raná, 22 iii.1999, P. Moravec & J. Růžička leg., cNBA; 1 female, labelled Bohemia, České středohoří, Raná u Loun, 25 v.1984, Šilha leg , cMAR; 1 male, 1 female, same data, but 21 x.1989, leg I. Mareček, cMAR, 9 males, 1 female, labelled: Bohemia bor., Raná p Louny, 17 ix 1983, leg M Rejzek, cREJ; 1 male, labelled. Bohemia, Raná u Loun, 14 x 1989, Hoskovec lgt , cJUR; 1 male, same data, but 22.ix 1990, cJUR; 1 female, labelled: Bohemia b., Raná, 28 x.1992, M Jaroš leg , cKLI; 1 male, 4 females, labelled: Bohemia b., Raná, 10 iv.1993, O Odvárka leg , cGEB, cKLI, 1 male, 1 female, labelled· Bohemia, Raná u Loun, 12 ix 1993, J Jurčiček lgt., cJUR; 1 male, labelled Boh[emia], Raná, Louny env , 7 xi 1993, cGEB; 3 males, 4 females, labelled Bohemia, Raná u Loun, 20 ix.1994, J Schneider lgt , cČRV, cJAN, cSCH; 1 female, labelled: Bohemia, Raná u Loun, 28.viii 1994, Kučera lgt , cJUR Sedlo 1 male, labelled· Bohemia bor , České Středohoří, vrch Sedlo pr Liběšice, 620 m , 9 ix 1994, P Moravec lgt., cPMO, 2 females, same data, but 23 v 1995, P Moravec leg , cPMO, cFAR Srbsko 2 females, labelled Boh[emia], [Český kras], Srbsko, 12.iii.[19]67, Vl Malý lgt., cGTT, cMAL; 1 male, same data, but 15 x [19]67, cHŮR; 2 females, same data, but 24.iii.[19]68, cFAR, cTĚŤ. Srdov: 4 males, 3



Figs 16–19. Habitus of holotypes (16, 18) and allotypes (17, 19) of: 16, 17 – *Leistus* (*Pogonophorus*) *montanus corconticus* ssp. n.; 18, 19 – *L.* (*P.*) *m. kultianus* ssp. n. Scale 1 mm.

females, labelled: Bohemia bor., České středohoří, Srdov, 12.x.1966, J. Pulpán leg., cPUL; 1 male, 1 female, labelled: Bohemia bor., České středohoří, vrch Srdov, 4.ix.1993, cJAR; 2 males, 2 females, labelled: Bohemia, České Středohoří, v. Srdov, 4.ix.1993, P. Moravec leg., cPMO; 1 male, 5 females, labelled: Bohemia sept., České středohoří, Strdlov [= Srdov ?], N of Louny, 18.iv.1965, 440 m, M. Fassati leg., cHEI, cFRE, cFSS; 1 male, same data, but 20.iv.1973, cFSS. Stráž nad Ohří: 2 males, 1 female, labelled: Bohemia oc. [5644], Stráž n.O., Himlštejn, 3.xi.1992, 400–480 m, J. Hejkal lgt., cHEJ, cFAR; 2 males, 1 female, labelled: Bohemia, Doupovské hory, Stráž nad Ohří, Ivo Těťál lgt., cTĚŤ. Svor: 4 males, 2 females, labelled: ČSSR Bohemia b., Svor, 16.x.[19]83, [R.] Marschner lgt., cKAŠ, cBUL; 2 females, labelled: Boh[emia] Svor, 16.x.1983, cKAŠ; 1 specimen, labelled: Bohemia, Svor, 24.v.1954, Říha lgt., cLAK; 1 specimen, same data, but 17.x.1980, cLAK. Týřov: 1 male, labelled: Bohemia centr., Křivoklátsko [4860], Týřovické skály, 73. km tok Berounky, 1.iv.1994, J. Růžička leg., cFAR. Ústí nad Labem.: 1 female, labelled: Bohemia b., Ústí nad Labem env., Průčelská rokle, 30.v.1994, P. Bulirsch lgt., cFAR; 3 males, 7 females, same data, but 28.v.1994, cBUL, cFAR; 2 males, 1 female, the same data, but 17.vi.1994, cPRO; 1 male, same data, but 6.v.1994, cKME; 2 males, same data, but v.1994, cJAN; 4 males, 2 females, labelled: Bohemia, Průčelská rokle, vrch malý Ostrý, 3.ix.1993, P. Moravec leg., cPMO; 4 males, 3 females, same data, but 11.v.1995, cPMO; 1 male, labelled: Bohemia bor., České středohoří, Průčelská rokle, 24.ix.1995, M. Jaroš lgt, cVON. Vršetín: 1 female, labelled: Boh. centr., Vršetín-východ, 5.v.[19]63, [K.] Hůrka lgt., cHŮR. Zlatník: 2 males, 1 female, labelled: Bohemia bor., České středohoří, Zlatník, 31.v.1994, P. Moravec lgt., cPMO; 18 males, 6 females, same data, but 27.ix.1994, cPMO, cFAR, cKLI, cSME. Želenický vrch: 9 males, 7 females, labelled: Bohemia, České středohoří, Želenice, 12.x.1966, J. Pulpán leg., cPUL; 1 male, 2 females, labelled: Bohemia, České středohoří, Želenický v., 19.iv.1994, P. Moravec lgt., cPMO; 1 male, 2 females, same data, but: 31.v.1994, cPMO; 1 male, same data, but 27.ix.1994, cPMO; 1 male, same data, but 5.iv.1995, cPMO. Localities in Germany: 1 male, labelled: Sä.[-chsische] Schw[ei]z, Schmilka, 27.iv.1963, *L. spinibarbis* F., cGEB; 1 male, labelled: Sä.[-chsische] Schw[ei]z, Rauenstein, Hohle am Pudelstein, 7.i.1972, Barberfalle: Formalin 30/0, *L. spinibarbis montanus* Steph., det. Dr. Horvatovich, cSMD.

ETYMOLOGY. Patronymic, the new subspecies was named in memory of the renowned Czech carabidologist, Prof. Karel Kult from Praha.



Figs 20, 21. Habitus of holotype (20) and allotype (21) of *Leistus* (*Pogonophorus*) *montanus pawlowskii* ssp. n. Scale 1 mm.

DISTRIBUTION (Fig 6) Czech Republic (Bohemia) Blešenský vrch [5549], Boreč [5449], Bořeň [5448], Brdy (Jordán) [6249], Čertova jizba [5350], Česká Kamenice (Zamecky vrch) [5252], Česká Kamenice (vrch Studenec) [5152], Davle [6052-6152], Jílove u Prahy [6152], Hazmburk [5550], Kletečná [5449], Klíč u Nového Boru [5253], Lány [5849], Nehvizdy [5854], Oblik [5548], Ovčin [5449-5450], Plešivec [5450], Praha (Hlubočepy, Řeporyje) [5952], Ralsko [5354], Rana [5548], Sedlo u Liběšic [5451], Srbsko [6050], Srdov [5548], Stráž nad Ohří (Hlmlštejn) [5644], Svor [5253], Ústi nad Labem (Brna, Průčelska rokle, vrch Maly Ostrý) [5350], Týřov [6048], Vršetín [5549], Zlatník [5448], Želenický vrch [5448], Germany (Saxonian Switzerland) Schmilka, Rauenstein
ACTIVITY January (1/0), March (2/5), April (35/34), May (54/54), June (30/37), July (11/22), August (5/12), September (133/83), October (121/77), November (5/2) Very rare and very localized in screes and dry, not shaded habitats in hills and in lowlands

Leistus (Pogonophorus) montanus pawlowskii ssp. n.
(Figs 9, 14–15, 20–21)

DESCRIPTION (habitus of holotype and allotype as in Figs 20–21) Body length 7 6–9 1 mm (mean 8 50 mm), holotype 8 5 mm, allotype 9 0 mm, males 7 6–8 6 mm (mean 8 26 mm), females 8 1–9 1 mm (mean 8 73 mm) Blue to greenish-blue, rarely with purplish hue, shiny Underside piceous-black Lateral bead of pronotum and elytra and epipleura brownish Mandibles, maxillary appendages, antennae and entire legs brownish-red to brownish-yellow Head with prominent eyes, area between eyes finely punctate IA = 1 20–1 34 (mean 1 27)

Pronotum (Fig 9) markedly cordiform (IPm/b = 1 52–1 70 (mean 1 64)), lateral bead evenly wide, flattened, lateral margin only slightly emarginate in front of posterior angles Posterior angles obtusely angulate to almost rectangular Punctures on middle of pronotal disc small, coarser Anteromedial depression and basal impression with large, coarse punctures IPw/l = 1 41–1 56 (mean 1 46)

Elytra (Fig 9) almost parallel-sided (IEl/w = 1 53–1 82 (mean 1 70)), with humeral tooth Punctation of elytral striae finer, but distinctive Macropterous, wings 1 28–1 37 as long as elytral width Scutellar setiferous punctures 1+1, dorsal setiferous punctures 1–5 IE/P = 1 18–1 32 (mean 1 24)

Aedeagus (Figs 14–15) with apical portion obliquely truncate, apex prominent
AFFINITIES Differential diagnosis may be found in the key The differences in the shapes of the pronota, elytra and aedeagi of the new subspecies are shown in Figs 7–15

TYPE MATERIAL **Holotype** Male, labelled [Poland], Babia gora, M Rybinski [leg] /coll M Fassati, 1946, ex coll Makolski, Varšava, cFSS **Allotype** Female, labelled Slovakia, Babia gora, 23 vi 1996, [A] Vrzecionko leg , cFAR First record of *L montanus* for Slovakia **Paratypes** Thirty-five specimens Localities in Poland 2 males 2 females, labelled Polonia m , distr Myslenice, Babia Góra, 30 vi –1 vii 1898, leg Stobiecki, ex coll Stobiecki Inst Zool PAN Krakow, 32/57, cFAR, cFSS, cSTO, cHŮR, 9 males, 6 females same data, but 24 vi 1905, cBUL, cFAR cFSS, cLIN cMAR, cPMO, cSTO, cVES, cWRA, cHŮR, 1 male, same data, but 12 vii 1896, cFSS, 1 male, 1 female, labelled Galicia Babia gora, 28 vi 1912, F Bluhweiss leg ex coll A Winkler, Wien, 1944, cFSS 1 male, labelled Babia gora, 30 vi [?], coll M Fassati, 1946, ex coll Makólski Varš , cFSS, 1 female, labelled Babia Gora, 8 vii 1948, Biolowski leg , cPUL, 2 females, labelled Polonia m , Babiagorski PN , 25 v 1961, J Pawlowski leg , det J Pawlowski as *L montanus* Steph , cFSS, 1 female, labelled Babia Gora, 17/174, ex coll M Rybinski Inst Zool PAN , Krakow, 34/57, cFSS, 1 male, 3 females labelled Polonia mer , [6483] Beskid Zywiecki, Babia gora mt , 20 –23 vi [19]98 [J] Stanovsky lgt , cFAR, cSTA, 1 male, labelled Polsko, 19 vi 1998 Babia Gora, lgt Orszulik, cLOH, 1 male, labelled Polska, Babia gora, 26 vi 1998, Kolomičny leg , cKME 1 male Babia Gora, [without precise data], collectio V Zoufal, Moravske museum Brno cZMB, Localities in Slovakia 1 female, labelled Slovakia, Babia góra, 23 vi 1996, [A] Vrzecionko leg , cKLI (first record (with allotype) of *L montanus* for Slovakia)

ETYMOLOGY Patronymic, the subspecies was named in honour of the renowned carabidologist, Dr Jerzy Pawlowski (Poland)

DISTRIBUTION (Fig. 6). Poland: Babia Góra; Slovakia: Babia Góra [6483].
ACTIVITY. May (0/2), June (15/13), July (2/1), August (0/1). Very rare; in screes.

Key to the subspecies of *Leistus montanus* Stephens, 1827

1 small subspecies (6.8–8.1 mm), posterior angles of pronotum sharp, elytral striae coarsely punctate, finer at apex, elytral apex elongate-acute . . .. *L. m. montanus* Stephens, 1827
Distribution: Great Britain, France, W Switzerland, N Spain
– larger subspecies (7.6–9.2 mm), posterior angles of pronotum more obtuse, elytral striae more finely punctate, elytral apex ± rounded 2
2 lateral margins of elytra ± parallel; elytra with blue to green hue, rarely with purplish hue. 3
– lateral margins of elytra rounded; elytra with pronounced, metallic blue hue, sometimes with purplish hue. ... 4
3 pronotum more transverse, punctation of pronotal disc coarser, aedeagus as in Figs 14–15 . . .. *L. m. pawlowskii* ssp. n.
Distribution: Babia Góra Mts. (Polish-Slovak boundary)
– pronotum less transverse, punctation of pronotal disc finer, aedeagus as in Figs 10–11. . . . . *L. m. corconticus* ssp. n.
Distribution: Krkonoše Mts. (Polish-Bohemian boundary)
4 slenderer subspecies (lEl/w 1.68–1.77), punctation of both elytral striae and pronotal disc finer .... *L. m. rhaeticus* Heer, 1837
Distribution: the Alps (France, Switzerland, Italy, Slovenia)
– stouter subspecies (lEl/w 1.51–1.67), punctation of both elytral striae and pronotal disc coarser .. . . *L. m. kultianus* ssp. n.
Distribution: Czech Republic (Bohemia), Germany (Saxonian Switzerland)

CONCLUSIONS

The taxonomy of the subgenus *Pogonophorus* of the genus *Leistus* is quite difficult, particularly the identification of the European species related to *Leistus montanus*. It may be postulated that the original, preglacial distributional range of this Hercynian species included considerable portion of Europe, particularly of western Europe, and that during the postglacial period the species was evolving in groups of isolated populations. A meaningful clarification of the relationships of the taxa of this complex may be attempted only after a detailed study of large numbers of specimens from different localities not only on the Balkan Peninsula, in Turkey, Syria, and on the Iberian Peninsula, but also from the mountain ranges in Italy, southern Germany, Switzerland and France. Unfortunately, we were not able to include the material from the general collection of the Muséum d'histoire naturelle, Paris (two boxes containing specimens of the *Leistus montanus*-group were not available for extended study). Also, we were not able to assess the specimens from the xerothermic slopes at Wilhelmsfeld near Heidelberg (Heinz 1964), as well as from Baden-Württenberg (Trautner & Müller-Motzfeld 1995). However, after we have studied the available, very large relevant material, we believe that the complex of *Leistus montanus* includes the following species and subspecies distributed as follows:

L. montanus montanus Stephens, 1827. Great Britain, France, W Switzerland, N Spain
L. montanus rhaeticus Heer, 1837. France, Switzerland, Austria, N Italy, Slovenia
L. montanus corconticus ssp. n. Czech Republic (NE Bohemia), SW Poland
L. montanus kultianus ssp. n. Czech Republic (Bohemia), Germany (Saxonian Switzerland)
L. montanus pawlowskii ssp. n. S Poland, N Slovakia
L. puncticeps Fairmaire et Laboulbène, 1854. France
L. parvicollis Chaudoir, 1869. Bulgaria, Greece, Turkey, Syria

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REFERENCES

ASSMANN T 1993 Die Leistus-Arten der Oreobius-Gruppe Systematik, Taxonomie und Verbreitung (Coleoptera, Carabidae Nebriinae) *Mitt Entomol Gess Basel* **43** 42–68

BANNINGER M 1925 Neunter Beitrag zur Kenntnis der Carabinae die Nebrini *Entomol Mitt* **14** 329–343

BENEDIKT S & TĚŤAL I 1994 [Interesting findings of ground beetles (Coleoptera, Carabidae) and supplementary data concerning latest collections] *Zprav Zapadoc Poboč Čs Společ Entomol Plzeň, Carabidol* **2** 15–30 (in Czech)

BURAKOWSKI B , MROCZKOWSKI M & STEFANSKA J 1973 *Katalog Fauny Polski, Część XXIII, tom 2 , Chrząszcze – Coleoptera, Biegaczowate – Carabidae, część 1* [*Catalogue of Fauna of Poland Band 23, Part 2, Beetles – Coleoptera, Ground beetles – Carabidae*] Warszawa Panstwowe wydawnictwo naukowe, 232 pp (in Polish)

BURMEISTER F 1939 *Biologie, Ökologie und Verbreitung der europaischer Kafer, I Adephaga* Krefeld, 307 pp

CSIKI E 1946 *Die Kaferfauna des Karpaten-Beckens I Band Allgemeiner Teil und Caraboidea* Budapest, 798 pp

DVOŘAK M 1962 [World rarity in Nehvizdy] *Hlas Vychodu* **3** 4 (in Czech)

DVOŘÁK M 1992 [Leistus – ground beetle with catcher] *Živa* **40** 174–175 (in Czech)

GERHARDT J 1910 *Verzeichnis der Kafer Schlesiens preussischen und ostereichischen Anteils, geordnet nach dem Catalogus Coleopterorum Europae vom Jahre 1906 Dritte, neubearbeitete Auflage* Berlin J Springer, XVI+431 pp

GUEORGUIEV V B & GUÉORGUIEV B V 1995 *Catalogue of the ground-beetles of Bulgaria (Coleoptera, Carabidae)* Sofia Moscow Pensoft Publ , 279 pp

HAVELKA J 1985 [Beetles – Coleoptera Catalogue of central Polabí region] *Polabi, Vlastived Zprav* (Polabske Museum v Poděbradech) **25** 22–36 (in Czech)

HEER O 1837 *Die Kaeffer der Schweiz, kritische Bemerkungen und Beschreibungen der neuen Arten Zweiter Teil Erste Lief* Neuchatel Buchdruckerei von Petitpierre, 55 pp

HEINZ W 1964 Zur Faunistik der Carabidae No 1772 Pp 136–137 In WEISE E (ed) Kleine Mitteilungen *Entomol Blatter* **60** 134–138

HONCU M & PULPAN J 1974 Die Laufkafer (Coleoptera, Carabidae) im Gebiet Česka Lipa *Sborn Severoces Mus Ser Natur , Liberec* **6** 93–149 (in Czech, German abstr)

HONCU M & VONIČKA P 1996 [Ground beetles of the last military exercise ground in Ralsko] *Bezdez – Vlastivěd Sborn Českolipska* **5** 295–355 (in Czech)

HORION A 1941 *Faunistik der deutschen Kafer Band I Adephaga – Caraboidea* Krefeld Hans Goecke Verlag, 464 pp

HORVATOVICH S 1971 Taxonomic and Zoogeographic Investigations on the Subspecies of Leistus spinibarbis Fabr *Ann Histor-Natur Mus Natl Hung* **63** 165–176

HUDEČEK L 1930 [*Beetles – Coleoptera National history and geography of Central and Northern Moravia national history and geography of the Olomouc district*] Kroměříž, 360–375 (in Czech)

HURKA K 1958 Versuch einer Zusammenfassung der montanen Carabidenfauna von Krkonoše (Riesengebirge) (Coleoptera Carabidae) *Acta Faun Entomol Mus Natl Pragae* **3** 31–52

HURKA K 1996 *Carabidae of the Czech and Slovak Republics* Zlin Kabourek, 565 pp

HURKA K & KUNST M 1973 *Zaverečna zprava o faunistickem průzkumu radovesicke vysypky* [*Final report of faunistic research of Radovesice dumper*] Unpubl manuscript, Faculty of Science of Charles University, Praha Deposited at the KSPPOP [Regional Centre of Monument Care and Nature Preservation] in Usti nad Labem 102 pp (in Czech)

JEANNE C 1973 Carabiques de la peninsule Iberique (1e Supplement) *Bull Soc Linn Bordeaux* **3** 3–20

KOCH K 1989 *Die Kafer Mitteleuropas Okologie Band 1* Krefeld Goecke et Evers, 107 pp
KOLTZE W 1873 Eine entomologische Exkursion durch die Grafschaft Glatz und in das Riesengebirge *Berl Entomol Ztschr* **17** 206–210
KÖHLER F & KLAUSNITZER B 1998 Verzeichnis der Kafer Deutschlands *Entomol Nachr Ber, Beiheft* **4** 1–185
KULT K 1941 Přehled synonym českych Carabidů (1 část) Ubersicht der Synonymen der Carabiden Böhmens (1 Teil) *Čas Čs Společ Entomol* **38** 15–25 (in Czech)
KULT K 1947 *The Carabidae from Czechoslovakia Entomologicke příručky č 20* Praha Československá společnost entomologicka 198 pp (in Czech, Engl summ)
LEDER H 1872 Erster Nachtrag zu E Reitters Uebersicht der Kafer-Fauna von Mahren und Schlesien *Verhandl Naturf Ver Brunn* **30**(1871) 86–139
LETZNER K 1871 Verzeichniss der Kafer Schlesiens *Ztschr Entomol Breslau* **2** 1–328
LETZNER K 1885–1891 Verzeichniss der Kafer Schlesiens – 2 Aufl fortges u vollend v J Gerhardt *Suppl Ztschr Entomol Breslau* **14** 1–438
LINDROTH C H 1974 *Handbooks for the Identification of British Insects IV, part 2 Coleoptera, Carabida* Royal Entomol Soc , London, 148 pp
LOMNICKI A 1963 The Distribution and Abundance of Ground-Surface-Inhabiting Arthropods above the Timber Line in the Region of Žolta Turnia in the Tatra Mts *Acta Zool Cracov* **8** 183–249
MAKÓLSKI J 1952 [*Family Carabidae in collection of Wojciech Maczynski*] *Fragm Faun Mus Zool Pol* **6** 207–241(in Polish)
MARGGI W A 1992 *Faunistik der Sandlaufkafer und Laufkafer der Schweitz (Cicindelidae & Carabidae) Coleoptera* Laussanne Documenta Faunistica Helvetiae Teil 1, 447 pp , Teil 2, 243 pp (Verbreitungskarten)
MARTIŠ M 1972 *Střevlikovití (Coleoptera, Carabidae) interkalarni a alpinske zony zapadnich Krkonoš* [*Ground beetles (Coleoptera, Carabidae) of intercalar and alpine zone of western Krkonoše Mts*] Unpubl MSc Thesis, Charles University, Praha, 245 pp (in Czech)
MARTIŠ M 1975 [Ground beetles (Coleoptera, Carabidae) of alpine zone of western Krkonoše Mts] *Opera Corconica* **12** 109–135 (in Czech)
MAŘAN J 1941 De lcisti montani Steph distributione et variatione geographica Coleoptera, Carabidae *Sborn Entomol Odd Zem Mus Praze* **19** 131–135 (in Czech and Latin)
MAŘAN J 1947 [Esquisse du peuplement des Montagnes Krkonoše] *Ochr Přir* **2**(5–6) 79–83 (in Czech)
MORAVEC P 1995 [Die Laufkaferartigen (Coleoptera, Carabidae) auf dem Hugel Rana im Bohmischen Mittelgebirge (Nordbohmen)] *Sborn Okres Muz Mostě, Ř Přirodov* **17** 38–48 (in Czech)
MROZEK-DAHL T 1928 *Die Tierwelt Deutschlands und der angrenzenden Meeresteile nach ihren Merkmalen und nach ihrer Lebensweise Coleoptera oder Kafer I Carabidae (Laufkafer)* Jena Verlag von Gustav Fischer, 210 pp
NOSKIEWITCZ J , SEMBRAT K & SZARSKI K 1961 [Interesting faunistic data of Karkonoski Park Narodowy] *Ochr Przyr* **27** 27–40
NOVÁK I 1989 [The list of places and their codes for grid maping of Czechoslovak entomofauna] *Zpr Čs Spolec Entomol* **25** 3–84 (in Czech)
OBENBERGER J 1952 *Krkonoše a jejich zvířena* [*Krkonoše Mts and their Fauna*] Praha Přirodovědecké vydavatelstvi, 291 pp (in Czech)
PAWLOWSKI J 1967 Chrzaszcze (Coleoptera) Babiej Gory The Beetles (Coleoptera) of Babia Gora Mt (Polish Western Carpathians) *Acta Zool Cracov* **12** 419–683 (in Polish, Engl and Russian summ)
PERRAULT G -G 1980 Le Genre Leistus (Frochlig) (Coleoptera, Carabidae) II Division en sous-genres *Bull Soc Linn , Lyon* **49** 456–464
PERRAULT G -G 1982 Le Genre Leistus (Frochlig) (Coleoptera – Carabidae – Nebriini) IV Le sous-genre Pogonophorus Latreille Division en Groupes d'espèces *Bull Soc Linn , Lyon* **51** 169–175
PERRAULT G -G 1992 Le Genre Leistus Frochlig (Coleoptera Carabidae Nebriini) XVI – Le groupe de L spinibarbis Γ (1) *Bull Mens Soc Linn , Lyon* **61** 15–24
PIČMAN Z 1979 K faunistice střevlikovitych brouků Československa 2 Zur Faunistik der Carabiden Tschechoslowakei 2 *Zpr Čs Spolec Entomol* **15** 105–108 (in Czech, German summ)
PRUNER L & MÍKA P 1996 List of settlements in the Czech Republic with associated map field codes for faunistic grid mapping system *Klapalekiana* **32**(Suppl) 1–175 (in Czech and English)
PULPAN J 1957 [Notes regarding of ecology and systematics of ground beetles of Czech Socialist Republic] *Mus Zpr Praž Kraje* **2** 82–84 (in Czech)
PULPAN J 1968 [Designation of the area and subarea of Czechoslovakia considering the faunistics of ground beetles (Carabidae, Coleoptera)] *Acta Mus Reginaehradec , Ser A* **9** 95–146 (in Czech)
PULPÁN J & HURKA K 1993 Carabidae Pp 12–22 In JELÍNEK J (ed) Check-list of Czechoslovak Insects IV *Folia Heyrovskyana*, Suppl **1** 1–172 (in Czech and English)

PULPAN J & TABORSKY I 1983 [Ground beetles of North-Eastern Bohemia (Coleoptera, Carabidae)] *Sborn Okr Muz Most* **5** 1–66 (in Czech)
RAZOWSKI J 1991 *Check-list of Animals of Poland Vol III, Part XXXII/22, 23, Insecta Coleoptera, Strepsiptera* Krakow Krakowskie Wydawnictwo Zoologiczne, 217 pp
RIEHN H 1914 Ein für Deutschland neuer Carabidae, sowie noch einige neue Fundorte deutscher oder Harzer Kafer *Deutsch Entomol Ztschr* **1914** 405–415
ROUBAL J 1926 Coleoptera Bohemiae nova *Čas Čs Společ Entomol* **22**(1925) 106–107 (in Czech, with Latin title)
SCHUBERT F 1904 Vereinsnachrichten *Ztschr Entomol Breslau, N F* **29** 15
STEPHENS J F 1828 *Illustrations of British entomology or a Synopsis of Indigenous Insects Mandibulata I* London Baldwin & Cradock, 188 pp
STREJČEK J 1973 [New or otherwise interesting species of beetles from Bohemia] *Zpr Čs Spolec Entomol, Praha* **9** 57–67 (in Czech)
ŠMAHA J 1982 [Some results of the entomofauna research in the Křivoklat surroundings] *Bohemia Centr* **11** 135–153 (in Czech)
TRAUTNER J & MÜLLER-MOTZFELD G 1995 Faunistisch-okologischer Bearbeitungsstand, Gefährdung und Checkliste der Laufkafer Eine Ubersicht für die deutschen Bundeslander *Natursch Landschaftsplan* **27** 96–105
VESELY J KODYM O, LOŽEK V, MAŘAN J, NOVAK F A, SMOLÍK L & ZÁRUBA Q 1954 *Ochrana československe přírody a krajiny Díl 2* [*Preservation of the Czechoslovak nature and landscape Part 2*] Praha Nakladatelstvi ČSAV, 706 pp (in Czech)
VESELY P & TĚŤAL I 1998 Interesting records of ground beetles (Coleoptera Carabidae) from Bohemia, Moravia and Slovakia in the years 1992–96 and supplementary data on earlier records *Klapalekiana* **34** 99–131 (in Czech, Engl summ)
VIGNA TAGLIANTI A 1993 *Coleoptera Archostemata, Adephaga 1 (Carabidae)* P 7 In MINELLI A, RUFFO S & LA POSTA S (eds) *Check-list delle specie della fauna italiana, 44* Bologna Calderini, 51 pp
VYSOKY V 1984 Beitrag zur Faunistik der Kafer Nordwestbohmen 2 (Coleoptera) *Zpr Čs Spolec Entomol* **20** 83–85 (in Czech, German summ)
VYSOKY V 1989 [Ground beetles in the Usti nad Labem district (Coleoptera Carabidae)] *Příroda Ustecka* **2** 1–149 (in Czech)

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Larvae of Pogonini (Coleoptera: Carabidae): genera *Pogonus*, *Pogonistes*, *Cardiaderus*, and *Thalassotrechus*

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Abstract. Larvae of the genera *Pogonus* Dejean, 1821, *Pogonistes* Chaudoir, 1871, *Cardiaderus* Dejean, 1828, and *Thalassotrechus* Van Dyke, 1918 of the tribe Pogonini are described. A key to the four genera and illustrations of the most important features are provided. Characters of larvae suggest that the tribe Pogonini represents a monophyletic lineage based on three synapomorphies: 1) presence of spindle-shaped setae on some parts of the body, 2) position of the seta FR_2 on frontale near FR_1; 3) absence of a relatively long secondary seta on each lateral margin of the ninth abdominal tergite (just anteriad to UR_2) in second and third instars. This study supports inclusion of Pogonini in the supertribe Trechitae together with Bembidiini, Trechini and Zolini. Both *Cardiaderus* and *Thalassotrechus* are very distinct and their relationships uncertain. Monophyly of *Pogonus* and *Pogonistes* is not evident, presumably these taxa are more related to each other than to the other two genera treated.

Morphology, phylogeny, description, key, larvae, Coleoptera, Carabidae, Pogonini, *Pogonus*, *Pogonistes*, *Cardiaderus*, *Thalassotrechus*

INTRODUCTION

The tribe Pogonini is represented in all major zoogeographical regions of the world but is most diverse in the Palaearctic, particularly in the Mediterranean area. This group includes about 70 species, which are classified in the genera *Bedeliolus* Semenov, 1900, *Cardiaderus* Dejean, 1828, *Diodercarus* Lutshnik, 1931, *Diplochaetus* Chaudoir, 1871, *Ochtozetus* Chaudoir, 1871, *Pogonistes* Chaudoir, 1871, *Pogonopsis* Bedel, 1898, *Pogonus* Dejean, 1821, *Syrdenus* Chaudoir, 1871, and *Thalassotrechus* Van Dyke, 1918 (Bousquet & Laplante 1997). In addition, Komarov (1996) recently described, as a pogonine, a genus with uncertain affinities (*Olegius*) based on a single female collected in southwestern Turkmenia. The tribe Pogonini is currently placed in the supertribe Trechitae along with Trechini, Zolini (Merizodini of some authors) and Bembidiini (including Tachyina) (Kryzhanovskij 1976, 1983; Erwin 1985, 1991). All species, except apparently those of *Ochtozetus* from South America (see Reichardt 1974), live in saline habitats and are found in littoral places or around inland salt lakes, ponds or pans.

Very little is known about Pogonini larvae. Morphological descriptions of older-instar larvae of only four species included in two genera have been published: *Pogonus cumanus* (Sharova 1958, 1964), *P. luridipennis* (Jeannel 1941; van Emden 1942; Sharova 1958, 1964; Larsson 1968; Raynaud 1976, Luff 1985, 1993; Arndt 1991), *P. chalceus* (Luff 1985, 1993; Arndt 1991), and *Thalassotrechus barbarae* (Moore 1956; Thompson 1979).

The main purpose of the present paper is to describe the larval features of four genera of the tribe *Pogonini*. In addition, relationships between these genera based on larval morphology will be briefly discussed.

MATERIALS AND METHODS

This work is based on the study of 46 slide-mounted larvae of Pogonini belonging to 11 species and four genera, 62 additional larvae were available in alcohol but not studied in detail. All larvae, except one specimen, were reared *ex ovo* from mature females kept in laboratory. Adults were collected during expeditions by the senior author along saline lakes in southern Ukraine (Dnestrovsky and Kuyalnisky Limans in the Odessa district), southern Russia (Sarepta in Volgograd area and Baskunchak Lake in the Astrakhan district), and southwestern Turkmenia (Uzboy Lakes system, southwestern part of the Kara Kum). Larvae of *Thalassotrechus barbarae* were borrowed from the Canadian National Collection of Insects, Ottawa, Canada (CNC). Most larvae are kept in the collection of the senior author (VVG), the remaining have been deposited in CNC, the British Museum of Natural History, London (BMNH), and Martin L. Luff collection, University of Newcastle upon Tyne (MLL).

Larvae were mounted on microscope slides in Hoyer's medium and studied with a compound microscope MBI-1 at magnifications up to 900×. Morphological drawings were prepared using a Reichert camera lucida. Notation of primary sensilla follows Bousquet & Goulet (1984), notation of secondary setae follows Bousquet (1985).

All measurements were made using an ocular micrometer. Measurements of antennomeres were taken along their medial side, including the membranous part. The abbreviations L_1, L_2, L_3 indicate first, second, and third instars respectively.

For comparative purpose, larvae of 22 genera belonging to the supertribe Trechitae have been studied: *Aepopsis* Jeannel, 1922, *Temnostega* Enderlein, 1905, *Perileptus* Schaum, 1860, *Thalassophilus* Wollaston, 1854, *Amblystogenium* Enderlein, 1905, *Trechus* Clairville, 1806, *Epaphius* Samouelle, 1827, and *Trechimorphus* Jeannel, 1927 of the tribe Trechini, *Bembidion* Latreille, 1802, *Asaphidion* Des Gozis, 1886, *Ocys* Stephens, 1828, *Phrypeus* Casey, 1924, *Tachys* Dejean, 1821, *Paratachys* Casey, 1918, *Sphaerotachys* G. Muller, 1926, *Elaphropus* Motschulsky, 1839, *Porotachys* Netolitzky, 1914, *Tachyta* Kirby, 1837, *Polyderis* Motschulsky, 1862, and *Mioptachys* Bates, 1882 of the tribe Bembidiini; *Oopterus* Guérin-Méneville, 1841 and *Idacarabus* Lea, 1910 of the tribe Zolini.

No descriptions of species are provided in this paper in part because the number of available larvae was low. A preliminary analysis indicates that differences among most pogonine species are slight, especially in the second and third instars.

Tribe Pogonini

DIAGNOSIS. Larvae of Pogonini differ from those of other groups included in the supertribe Trechitae by the presence of spindle-shaped setae (see Fig. 17) on some sclerites. In the first instar, at least setae ES_1 on pro- and mesothorax, EP_1 on ninth abdominal segment, and PY_2 on pygidium are spindle-shaped. In the second and third instars, there are numerous short, secondary, spindle-shaped setae on the dorsal surface of the cephalic capsule. Such modified setae are absent in larvae of other Trechitae examined. In addition to this character, we should mention (1) that the frontal sutures are less sinuate in larvae of Pogonini compared to those of other Trechitae groups, (2) that seta FR_2 on the frontale is closer to FR_1 than on average for Trechitae, and (3) that each lateral margin of the ninth abdominal tergite in second and third instars lacks a secondary seta (just anteriad to UR_2) present in most Trechitae larvae known to us.

DESCRIPTION. Head widths of specimens studied are indicated in Table 1. **First-instar larvae.** Moderately sclerotized; coloration varying from very light, almost colorless, to somewhat brown or grey. Cephalic capsule without basal constriction; parietale with 2 rows of 3 ocelli in most species, ocelli of posterior row small to absent in some species; postocellar and cervical grooves present or not. Frontal sutures only slightly sinuate (Figs 2–9); epicranial suture relatively long, 0.7–1.0× as long as antennomere 1 (Figs 2–9); nasale variable (Figs. 10–14), somewhat produced and denticulate, with a single row of denticles (Figs 10–14). Egg-bursters absent (Figs 2–5, 7–9) except in *Thalassotre-*

Tab 1 Cephalic capsule width (mm) of pogonine larvae studied

	L1			L2		L3	
Species	n	M	Range	n	M	n	M
Pogonus luridipennis	2	0 56	0.55–0.56	1	0 75	1	1 35
Pogonus iridipennis	1	0.43		–		1	1.07
Pogonus transfuga	2	0 48	0.47–0 48	1	0.70	1	1 18
Pogonus meridionalis	4	0 46	0 45–0.48	1	0 69	1	1.13
Pogonus punctulatus	2	0 36	0.35–0.38	1	0.51	1	0 63
Pogonus cumanus	1	0 56		–		1	1 35
Pogonistes rufoaeneus	1	0 39		1	0 54	1	0 70
Pogonistes convexicollis	2	0 34	0 33–0.34	1	0 50	1	0 62
Pogonistes angustus	2	0 32	0 30–0 33	2	0 41	1	0 57
Cardiaderus chloroticus	2	0 50	0 47–0.52	1	0.81	1	1 10
Thalassotrechus barbarae	1	0 46		–		–	

chus (Fig. 6). Antennae slightly longer than mandibles in most species; second antennomere 0.7–1.0× as long as first; third antennomere 1.1–1.3× as long as first; fourth antennomere 0.6–0.9× as long as first; antennomere 3 with prominent sensorium (sensorial appendage of Van Emden 1942), two campaniform and one placoid sensilla laterally; antennomere 4 with two conical and one campaniform sensilla apically; lateral side of antennomere 3 not sclerotized between sensorium and base of antennomere 4. Mandible with single retinaculum; penicillus with more than 5 setae; cutting edges of terebra and retinaculum smooth, not serrate (Figs 2–9); dorsal surface between MN_b and MN_1 with or without microdenticles. Maxilla without lacinia; stipes about 2.2–3.0× as long as wide; dorsal surface of stipes membranous, not sclerotized; first galeomere 1.0–1.2× as long as second; maxillary palpomere 4 not subdivided. Labium with relatively long, conical ligula; second labial palpomere not subdivided, slightly shorter than first. Leg with single, relatively long claw (Figs. 15–16). Urogomphi fused to ninth tergite, rather long, not joined, without nodules.

Chaetotaxy. All primary sensilla, except pores PR_e, PR_e, PR_i, PR_j, in some taxa also PR_h, on pronotum, pores ME_d, ME_e on meso- and metanotum, seta ES_1 on metathorax, pore TE_b on abdominal tergites 1–8, and setae TA_3, TA_4, TA_5 and TA_6 on tarsus, present; no additional sensilla. Seta FR_1 close to FR_2; anterior angles of hypopharynx each with one seta; setal group gMX with 14–30 (usually less than 24) setae; setae MX_5 and MX_6 relatively long and subequal in length; seta MX_7 about half length of galeomere 2; seta MX_8 located at base of galeomere 2; seta LA_5 located on ligula, which is quadrisetose. Setae PR_7 and ME_{10} on thorax short, not longer than basal diameter of nearest long setae; length of setae PR_{13} and ME_{14} 0.4–0.7× that of PR_{12} and ME_{13} respectively; seta ES_1 spindle-shaped; seta EM_1 spindle-shaped except in *Pogonistes*. Seta TA_1 usually located at basal third of tarsus, rarely at middle. Abdomen with setae TE_6, TE_7, TE_{11} and ST_3 spindle-shaped in many taxa. Seta EP_1 on epipleurites of ninth abdominal segment and seta PY_2 on pygidium spindle-shaped.

Second- and third-instar larvae. Same character states as first instar except for the followings. Antennae with second antennomere 0.9–1.6× as long as first; third antennomere 1.1–1.5× as long as first; fourth antennomere 0.5–0.8× as long as first. Mandible without microdenticles on dorsal surface between pore MN_b and seta MN_1. Maxillae with dorsal surface of stipes partly sclerotized; stipes 3.5–5.5× as long as wide.

Chaetotaxy. Primary setae on frontale usually trichoid (FR_1 and FR_3 spindle-shaped in some specimens); frontale with numerous short, irregular, secondary setae, some of them spindle-shaped. Antenna without secondary setae (Figs 21, 24–25) or with secondary setae on antennomeres 1–3

(Figs 22–23), in some taxa on antennomere 2 only (Fig 26) Mandible with 2 or 3 secondary setae laterally at base Maxilla with group gMX consisting of 20–65 setae, lateral side of stipes with 5–7 setae (including MX_2 and MX_3), setae MX_5 and MX_6 long (length 1 5–2 5× width of stipes) Labium with 3–22 setae on each side (including LA_3 and LA_4) Leg without secondary setae in most species, rarely femur, tibia, and tarsus with short secondary setae Seta UR_α on abdominal tergite IX distinct, urogomphi each with 7 long setae (UR_4–UR_8, UR_5, UR_6), lateral margins of tergite IX without secondary seta at middle (just anteriad to UR_2)

Bionomics Although the habitat preferences of Pogonini larvae are inadequately known, one can assume that larvae of most species prefer saline places like the adults In laboratory, we were able to obtain eggs of many species only after table salt was added to the substratum in the Petri dishes containing the adults Most first-instar larvae were obtained in laboratory in June, usually right after the adults were brought from the field It takes about three to four weeks for the larval development to be completed All species collected in the field were successfully reared, except *Pogonus litoralis*

Monophyly Larval features suggest that the tribe Pogonini represents a monophyletic lineage Known larvae possess three character states which are likely apomorphic 1) Some setae on the body are spindle-shaped instead of trichoid No other Trechitae larvae possess such setae and their occurrence is rare in other groups of Carabidae 2) Seta FR_2 on frontale is located closer to FR_1 than on average for Trechitae and most other groups of Carabidae (our observations) 3) Pogonine larvae lack a relatively long, secondary seta on each lateral margin of the ninth abdominal tergite (just anteriad to UR_2) in second and third instars which is present in all other genera of Trechitae studied except *Ocys*, *Tachyta*, *Oopterus*, and *Idacarabus* This character state has been little surveyed in other groups of Carabidae

Phylogenetic Relationships Larval features of Pogonini support their inclusion in the supertribe Trechitae Pogonine larvae share with those of the remaining Trechitae groups the absence of pores PR_c, PR_e, PR_i, PR_j on pronotum, pores Me_d and ME_e on meso- and metanotum, seta ES_1 on metathorax, pore TE_b on abdominal tergites 1–8, and setae TA_3, TA_4, TA_5, TA_6 on tarsus These structures are part of the ground plan of the family Carabidae (Bousquet & Goulet 1984) and their absence in Trechitae larvae is very likely a synapomorphic condition

One additional character state should be mentioned the presence of a single claw at the extremity of the leg This state, which is undoubtedly derived for the family Carabidae, occurs in all Trechitae larvae except for those of the genera *Perileptus*, *Thalassophilus*, *Amblystogenium*, *Temnostega*, and *Kenodactylus* Broun, 1909 which have two claws (Boldori 1936, Womersley 1937, Johns 1974 Grebennikov 1996, our observations) These genera belong to the subtribes Perileptina, Trechodina, Plocamotrechina, and Aepina (last two) respectively of the tribe Trechini Reversal from one to two claws within the Trechini is unlikely in our opinion Therefore, we must assume that the presence of one claw has been derived at least twice in the Trechitae, once in the tribe Trechini and a second time in the remaining groups In such case, the Pogonini may be more closely related to Bembidiini and Zolini The fact that a few other groups of Carabidae, apparently not closely related to the Trechitae such as some genera of Clivinini and the Broscini, do possess a single claw suggests that this character state may be subject to convergence in carabids Another possibility is that the tribe Trechini is not a monophyletic lineage We cannot comment on this hypothesis at this point

Muller (1975) postulated that the tribe Pogonini is the adelphotaxon of Bembidiini This view was based, in our opinion, on "weak" synapomorphies and has not been corroborated As properly stated by Maddison (1993 196), relationships of the various tribes of Trechitae have not been adequately demonstrated

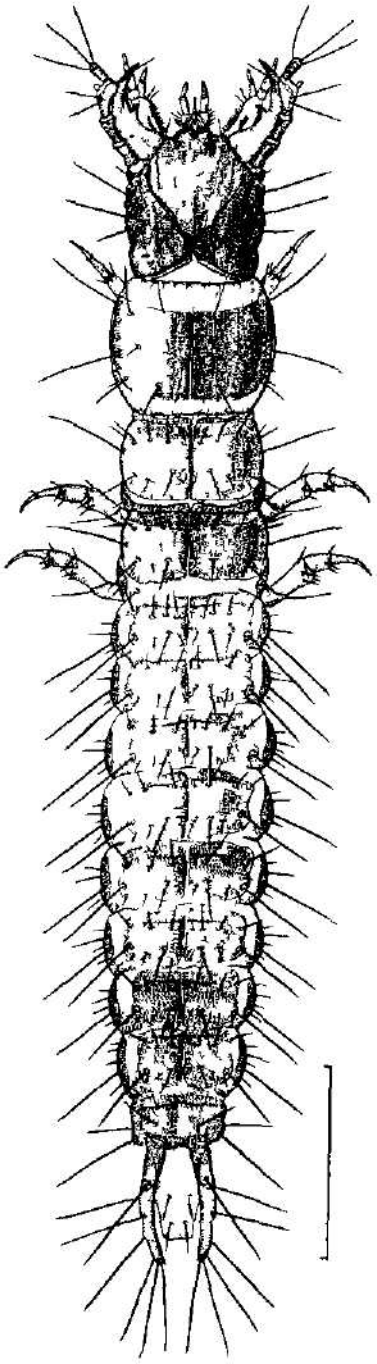


Fig. 1 Larva of *Pogonus meridionalis*, L_2 habitus Scale bar = 1 mm

Key to larvae of the tribe Pogonini

1 Urogomphus with 5 long setae (Figs 18–20) Mandible with one seta on basal half (Figs 2–9) Lateral side of stipes with 2 setae. Abdominal hypopleurites without setae. ..... First instar 2
– Urogomphus with 7 long setae (Fig 1). Mandible with more than one seta on basal half (Figs 24–26) Lateral side of stipes with more than 2 setae Abdominal hypopleurites with setae ..... Second and third instars 5
2 Dorsal surface of mandible between MN_1 and MN_b with at least one microdenticle, usually 3–6 (Figs 2–4). Seta PY_6 on pygidium spindle-shaped ..... *Pogonus* Dejean
– Dorsal surface of mandible between MN_1 and MN_b smooth, without microdenticles (Figs 5–9) Seta PY_6 on pygidium trichoid 3
3 Length of setae MX_{11} and MX_{12} more than half diameter of maxillary palpomere 3. Parietale with posterior row of ocelli somewhat reduced or absent ..... *Pogonistes* Chaudoir
– Length of setae MX_{11} and MX_{12} less than 1/4 diameter of maxillary palpomere 3 Parietale with posterior row of ocelli markedly developed 4
4 Parietale with egg-bursters consisting of one large microspine on each side near epicranial suture (Fig. 6) Mandibular terebra slightly convex near base (Fig. 6) Pore PR_b on pronotum absent. Setae TE_7 on tergites spindle-shaped ..... *Thalassotrechus* Van Dyke
– Parietale without egg-bursters (Fig 5) Mandibular terebra regular, slightly concave (Fig 5) Pore PR_b on pronotum present Setae TE_7 on tergites normal, trichoid ..... *Cardiaderus* Dejean
5 Antennae with secondary setae on antennomere 2 only (Fig 26) Length of setae MX_{11} and MX_{12} less than 1/4 diameter of maxillary palpomere 3 Meso-, metanotum, and abdominal tergites 1–6 with numerous secondary setae on medial half (Fig 27). ..... *Cardiaderus* Dejean
– Antennae without secondary setae (Figs 21, 25) or antennomeres 1–3 with secondary setae (Figs 22, 23) Length of setae MX_{11} and MX_{12} more than half diameter of maxillary palpomere 3 Meso-, metanotum, and abdominal tergites 1–6 with no or few secondary setae on medial half ..... *Pogonus* Dejean and *Pogonistes* Chaudoir

Genus *Pogonus* Dejean, 1821
(Figs 1–4, 10, 19, 21–25)

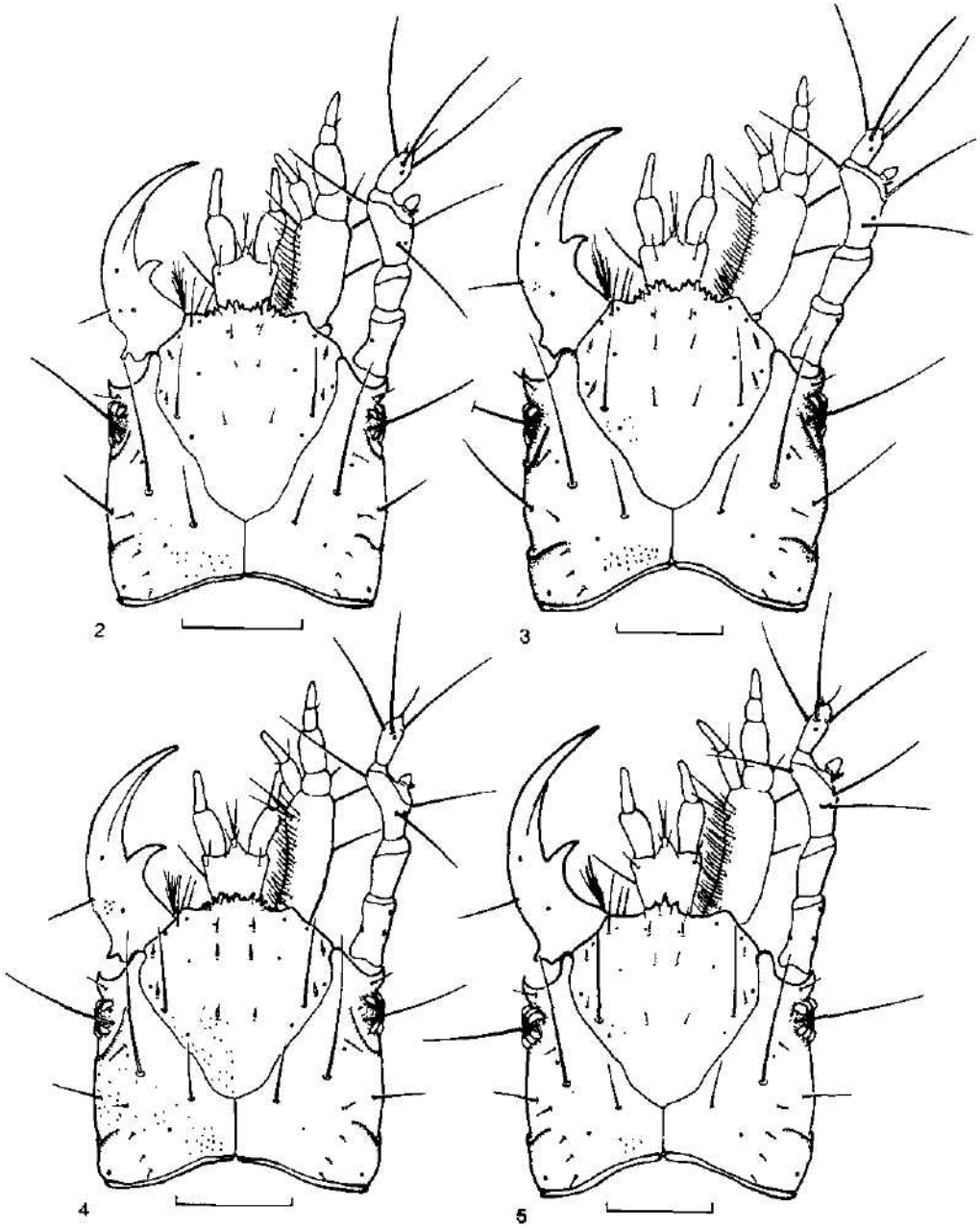
DIAGNOSIS. First-instar larvae of *Pogonus* differ from those of other genera by having microdenticles on the dorsal surface of the mandible between MN_b and MN_1 and by having the seta PY_6 on the pygidium spindle-shaped. We have found no character state that would differentiate second- and third-instar larvae of *Pogonus* from those of *Pogonistes*.

DESCRIPTION. **First-instar larvae.** Cephalic capsule parallel-sided (Figs 2–4) Frontale with or without pointed microsculpture, if present, microsculpture developed on basal half of sclerite (Fig. 4) or near pore FR_b (Fig. 3); nasale rather straight or slightly notched at middle (Figs 10, 11). Parietale without egg-bursters (Figs 2–4); ocelli, postocellar and cervical grooves markedly developed (Figs 2–4). Mandible with pointed microsculpture between MN_b and MN_1 consisting of 1–8, usually 3–6, sharp microdenticles (Figs 2–4); terebra regular, slightly concave (Figs 2–4). Claw 0.8–1.0× length of tarsus. Urogomphi relatively long, parallel (Fig. 19).

Chaetotaxy: Seta AN_6 1.0–2.0× as long as width of antennomere 4 (Figs 2–4). Frontale with at least 2 setae, FR_1 and either FR_3, FR_4, or FR_6, spindle-shaped; seta EM_1 on prothorax and PY_6 on pygidium spindle-shaped; length of setae MX_{11} and MX_{12} more than half diameter of maxillary palpomere 3. Pore PR_b on pronotum present. Seta TA_1 located at basal third of tarsus (as in Fig. 15). Setae TE_7 on tergites normal, not spindle-shaped.

Second- and third-instar larvae. Postocellar and cervical grooves distinct.

Chaetotaxy: antennomeres 1–3 with (Figs 22, 23) or without secondary setae (Figs 21, 24). Leg without secondary setae on tarsus, tibia and femur in all species studied except *P. cumanus*. Meso-metanotum, and abdominal tergites 1–6 without numerous secondary setae on medial half of sclerites (Fig. 1).



Figs 2–5. Cephalic capsule, right antenna, left mandible, right maxilla, labium, L_1 (dorsal view). 2 – *Pogonus punctulatus*; 3 – *P. cumanus*; 4 – *P. luridipennis*; 5 – *Cardiaderus chloroticus*. Scale bars = 0.2 mm.

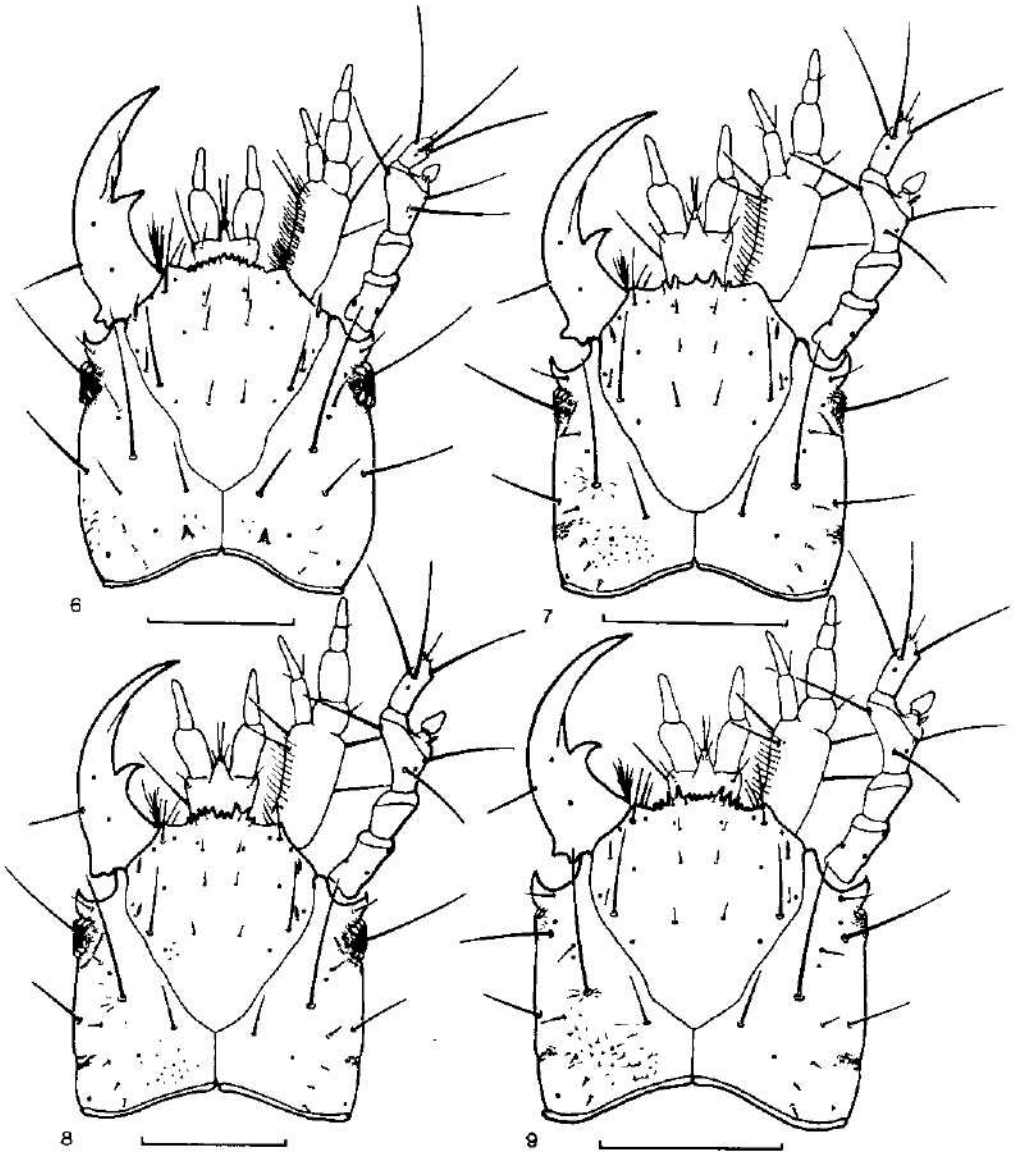
MONOPHYLY AND PHYLOGENETIC RELATIONSHIPS. In their taxonomic review of the New World Pogonini, Bousquet & Laplante (1997) found no synapomorphy for the genus *Pogonus* based on a limited number of species. They concluded that the genus, as presently conceived, may not be a monophyletic lineage. Known larvae of *Pogonus* share one apomorphic character state: in the first instar, the seta PY_6 on the pygidium is spindle-shaped instead of being trichoid. The presence of pointed microsculpture on the dorsal surface of the mandible of the first instar could represent another synapomorphy for the genus *Pogonus*. However, the transformation polarity of the character is difficult to assess. Presence of this feature occurs in several lineages within the supertribe Trechitae. Overall, evidence of monophyly for the genus *Pogonus* based on larval morphology is not overwhelming.

Among the genera treated here, *Pogonus* is probably more closely related to *Pogonistes* than to the other two genera. Larvae of *Pogonus* and *Pogonistes* have relatively long setae MX_{11} and MX_{12} on maxillary palpomere 3 (at least half width of the palpomere). This character state is rarely found in carabids, where these setae are extremely small. Relatively long setae MX_{11} and MX_{12} is likely the apomorphic state but its presence in the genus *Asaphidion* (see Maddison 1993. 153) suggests that it could be subject to convergence. The fact that no character state was found to separate second- and third-instar larvae of *Pogonus* from those of *Pogonistes* suggests also, in a way, that the two genera may be closely related.

MATERIAL STUDIED. *Pogonus luridipennis* (Germar, 1822): $2L_1$, $1L_2$, $1L_3$ (mounted on slide) reared from adults collected at Sarepta, Volgograd area, Russia on May 23, 1995 (VVG) *Pogonus iridipennis* Nicolai, 1822. $1L_1$, $1L_3$ (mounted on slide) reared from adults collected at Dnestrovsky Liman, Odessa distr., Ukraine on April 26, 1995 (VVG) *Pogonus transfuga* Chaudoir, 1870: $2L_1$, $1L_2$, $1L_3$ (mounted on slide) reared from adults collected at Baskunchak Lake, Astrakhan distr., Russia on May 25, 1995 (VVG), $1L_1$ (mounted on slide) reared from adults collected at Sarepta, Volgograd area, Russia on May 23, 1995 (VVG), additional material reared but not studied in detail includes $6L_1$, $2L_2$, and $1L_3$ (adults from Baskunchak Lake) (VVG). *Pogonus meridionalis* Dejean, 1828 $2L_1$, $1L_2$, (mounted on slide) reared from adults collected at Dnestrovsky Liman, Odessa distr., Ukraine on April 26, 1995 (VVG), $2L_1$, $1L_3$ (mounted on slide) reared from adults collected at Kuyalnisky Liman, Odessa distr., Ukraine on April 28, 1995 (VVG), additional material reared but not studied in detail includes $7L_1$, $3L_2$, $1L_3$ (BMNH, VVG) *Pogonus punctulatus* Dejean, 1828, $2L_1$, $1L_2$, $1L_3$ (mounted on slide) reared from adults collected at Dnestrovsky Liman, Odessa distr., Ukraine on April 26, 1995 (VVG); $4L_1$ (mounted on slide) reared from adults collected at Sarepta, Volgograd area, Russia on May 23, 1995 (VVG); additional material reared but not studied in detail includes $3L_1$ and $1L_3$ (VVG) *Pogonus cumanus* Lutshnik, 1916: $1L_1$ (mounted on slide) reared from adults collected at Kuyalnisky Liman, Odessa distr., Ukraine on April 28, 1995 (VVG); $1L_3$ (mounted on slide) collected with adults and identified by association (VVG)

GEOGRAPHICAL DISTRIBUTION AND DIVERSITY. The genus *Pogonus* includes about 45 species which are distributed worldwide, except in the Neotropical Region, but are most diverse in the Mediterranean area (Kryzhanovskij 1983; Bousquet & Laplante 1997) than anywhere else.

REMARKS. Second- and third-instar larvae of two species of *Pogonus*, namely *P. cumanus* and *P punctulatus*, are easily recognized among the species studied in having secondary setae on antennomeres 1–3 (Figs 22, 23). Additionally, the single third-instar larva of *P. cumanus* we have studied is unique for the presence of secondary setae on the femur (8–9 setae), tibia (3–7 setae) and basal part of tarsus (2–4 setae). First-instar larvae of *P. punctulatus* differ readily from the other species studied by the absence of microsculpture on frontale and by the presence of only one microdenticle on the dorsal surface of the mandible between MN_b and MN_1. Larvae of other *Pogonus* species have pointed microsculpture in the basal part of the frontale and from 3 to 8 microdenticles on the dorsal surface of the mandible.



Figs 6–9. Cephalic capsule, right antenna, left mandible, right maxilla, labium, L_1 (dorsal view). 6 – *Thalassotrechus barbarae*; 7 – *Pogonistes angustus*; 8 – *P. rufoaeneus*; 9 – *P. convexicollis*. Scale bars = 0.2 mm.

Genus *Pogonistes* Chaudoir, 1871
(Figs 7–9, 11–12, 18)

DIAGNOSIS. First-instar larvae of *Pogonistes* differ from those of other genera treated in having the seta EM_1 on prothorax normal, trichoid. Second- and third-instar larvae cannot be separated from those of *Pogonus*.

DESCRIPTION. **First-instar larvae.** Cephalic capsule parallel-sided (Figs 7–9). Frontale without microsculpture (Figs. 7,9) or with pointed microsculpture restricted to near pore FR_b (Fig. 8); nasale rather straight at middle (Fig. 12). Parietale without egg-bursters (Figs 7–9); ocelli, postocellar and cervical grooves less distinct than in *Pogonus* (Figs 7–8) or posterior row of ocelli and postocellar groove absent (Fig. 9). Mandible without microdenticles between MN_b and MN_1 (Figs 7–9); terebra regular, slightly concave (Figs 7–9). Claw 0.9–1.0× length of tarsus. Urogomphi relatively short, parallel (Fig. 18).

Chaetotaxy: Seta AN_6 1.0–1.5× as long as width of antennomere 4 (Fig. 7). Frontale with at least seta FR_6 spindle-shaped; seta EM_1 on prothorax, TE_7 on abdominal tergites, and PY_6 on pygidium normal, trichoid; length of setae MX_{11} and MX_{12} at least half diameter of maxillary palpomere 3. Pore PR_h on pronotum present. Seta TA_1 located at basal third of tarsus (as in Fig. 15).

Second- and third-instar larvae. Postocellar and cervical grooves distinct.

Chaetotaxy: Antennae and legs without secondary setae. Meso-, metanotum, and abdominal tergites 1–6 without numerous secondary setae on medial half of sclerites.

MONOPHYLY AND PHYLOGENETIC RELATIONSHIP. We found no larval synapomorphy among the species studied to support the view that the genus is monophyletic. Second- and third-instar larvae of *Pogonistes* are similar to those of *Pogonus*. In addition, larvae of both genera share the presumably apomorphic condition of relatively long setae MX_{11} and MX_{12} on maxillary palpomere 3. As stated previously *Pogonistes* is probably more closely related to *Pogonus* than to the other genera treated.

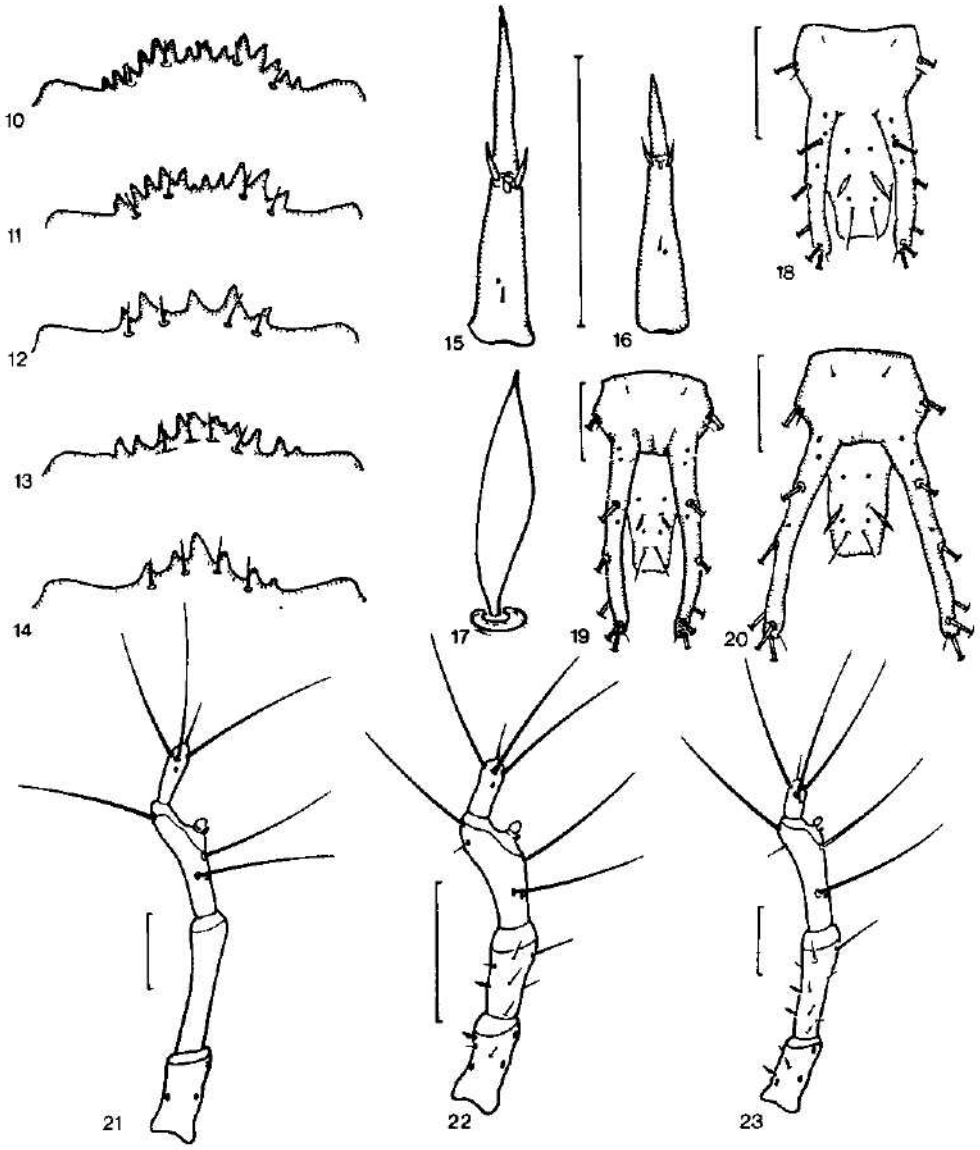
MATERIAL STUDIED *Pogonistes rufoaeneus* (Dejean, 1828): $1L_1$, $2L_2$, $1L_3$ (mounted on slide) reared from adults collected at Sarepta, Volgograd area, Russia on May 23, 1995 (VVG); $2L_1$, $2L_2$, $1L_3$ reared from adults collected in the Kara Kum Desert, Uzboy Lakes system, Turkmenia on April 28, 1995 (CNC), additional material reared but not studied in detail includes $4L_1$ and $1L_2$ (VVG). *Pogonistes convexicollis* Chaudoir, 1871: $2L_1$, $1L_2$, $1L_3$ (mounted on slide) reared from adults collected at Kuyalnisky Liman, Odessa distr., Ukraine on April 28, 1995 (VVG), *additional material reared but not studied in detail includes $1L_2$ (VVG).* *Pogonistes angustus* (Gebler, 1830): $2L_1$, $2L_2$, $1L_3$ (mounted on slide) reared from adults collected at Kuyalnisky Liman, Odessa distr., Ukraine on April 28, 1995 (VVG), additional material reared but not studied in detail includes $8L_1$ and $4L_2$ (VVG).

GEOGRAPHICAL DISTRIBUTION AND DIVERSITY. The genus *Pogonistes* includes about 10 species in the Mediterranean area (Kryzhanovskij 1983).

Genus *Cardiaderus* Dejean, 1828
(Figs 5, 14, 15, 26, 27)

DIAGNOSIS. Larvae of *Cardiaderus* are differentiated from those of other members of Pogonini by the character states listed in the key and by having, in the second and third instars, numerous secondary setae located on the medial half of the meso-, metanotum, and abdominal tergites. Furthermore the antennomere 2 bears secondary setae while the antennomeres 1 and 3 have no such setae. Only some members of the genus *Pogonus* also possess secondary setae on antennomere 2 but in these species the antennomeres 1 and 3 bear secondary setae.

DESCRIPTION. **First-instar larvae.** Cephalic capsule parallel-sided (Fig. 5). Frontale with pointed microsculpture near pore FR_b (Fig. 5); nasale with 6–7 teeth, median one somewhat more protruding



Figs 10–23 10–14, nasale, L_1 (dorsal view) 10 – *Pogonus luridipennis*, 11 – *Pogonistes rufoaeneus*, 12 – *P angustus*, 13 – *Thalassotrechus barbarae*, 14 – *Cardiaderus chloroticus* 15–16, tarsus and claw, L_1 (dorsal view) 15 – *Cardiaderus chloroticus*, 16 – *Thalassotrechus barbarae* 17 – spindle-shaped seta 18–20, urogomphi and pygidium, L_1 (dorsal view) 18 – *Pogonistes convexicollis*, 19 – *Pogonus luridipennis*, 20 – *Thalassotrechus barbarae* 21–23, right antenna, L_1 (dorsal view) 21 – *Pogonus luridipennis*, 22 – *P punctulatus*, 23 – *P cunanus* Scale bars = 0 2 mm

than others (Fig. 14). Parietale without egg-bursters (Fig. 5); ocelli and cervical groove markedly developed (Fig. 5); postocellar groove absent. Mandible without microdenticles between MN_b and MN_1 (Fig. 5), terebra regular, slightly concave. Claw as long as tarsus (Fig. 15). Urogomphi relatively long, parallel (as in Fig. 19).

Chaetotaxy: Seta AN_6 1.0–1.3× as long as width of antennomere 4 (Fig. 5). Frontale without spindle-shaped setae; seta EM_1 on prothorax spindle-shaped; setae TE_7 on abdominal tergites and PY_6 on pygidium normal, trichoid; length of setae MX_{11} and MX_{12} less than 0.25× diameter of maxillary palpomere 3. Pore PR_h on pronotum present. Seta TA_1 located at basal third of tarsus (Fig. 15).

Second- and third-instar larvae. Postocellar groove distinct; cervical groove absent.

Chaetotaxy: Antenna with secondary setae on antennomere 2 only (Fig. 26). Legs without secondary setae on tarsus, tibia and femur. Meso-, metanotum, and abdominal tergites 1–6 with numerous, more or less long, secondary setae on medial half of sclerites (Fig. 27).

Phylogenetic Relationship. Second- and third-instar larvae of the genus *Cardiaderus* show two apomorphic character states: the meso-, metanotum, and abdominal tergites bear numerous secondary setae on the medial half of the tergites (Fig. 27) and the antennomere 2 has secondary setae (Fig. 26). The last feature is shared with some species of *Pogonus* (*P. cumanus* and *P. punctulatus*). However, we believe that the presence of this state in both taxa appeared independently. For example, presence of secondary setae on the antennomere 2 has appeared in several lineages within the tribes Pterostichini (Bousquet 1985), Bembidiini and Trechini (our observations). Relationships of the genus *Cardiaderus* are uncertain.

Material studied *Cardiaderus chloroticus* (Fischer von Waldheim, 1823): $2L_1$, $1L_2$, $1L_3$ (mounted on slide) reared from adults collected at Kuyalnitsky Liman, Odessa distr., Ukraine on April 28, 1995 (VVG), additional material reared but not studied in detail includes $7L_1$, $4L_2$, $5L_3$ (VVG, CNC, BMNH)

Geographical distribution and Diversity. The genus *Cardiaderus* includes a single species, *C. chloroticus*, which is distributed throughout the steppe and semi-desert areas of Palaearctic Region from Romania and Bulgaria to eastern Kazakhstan and the Altai (Kryzhanovskij 1983).

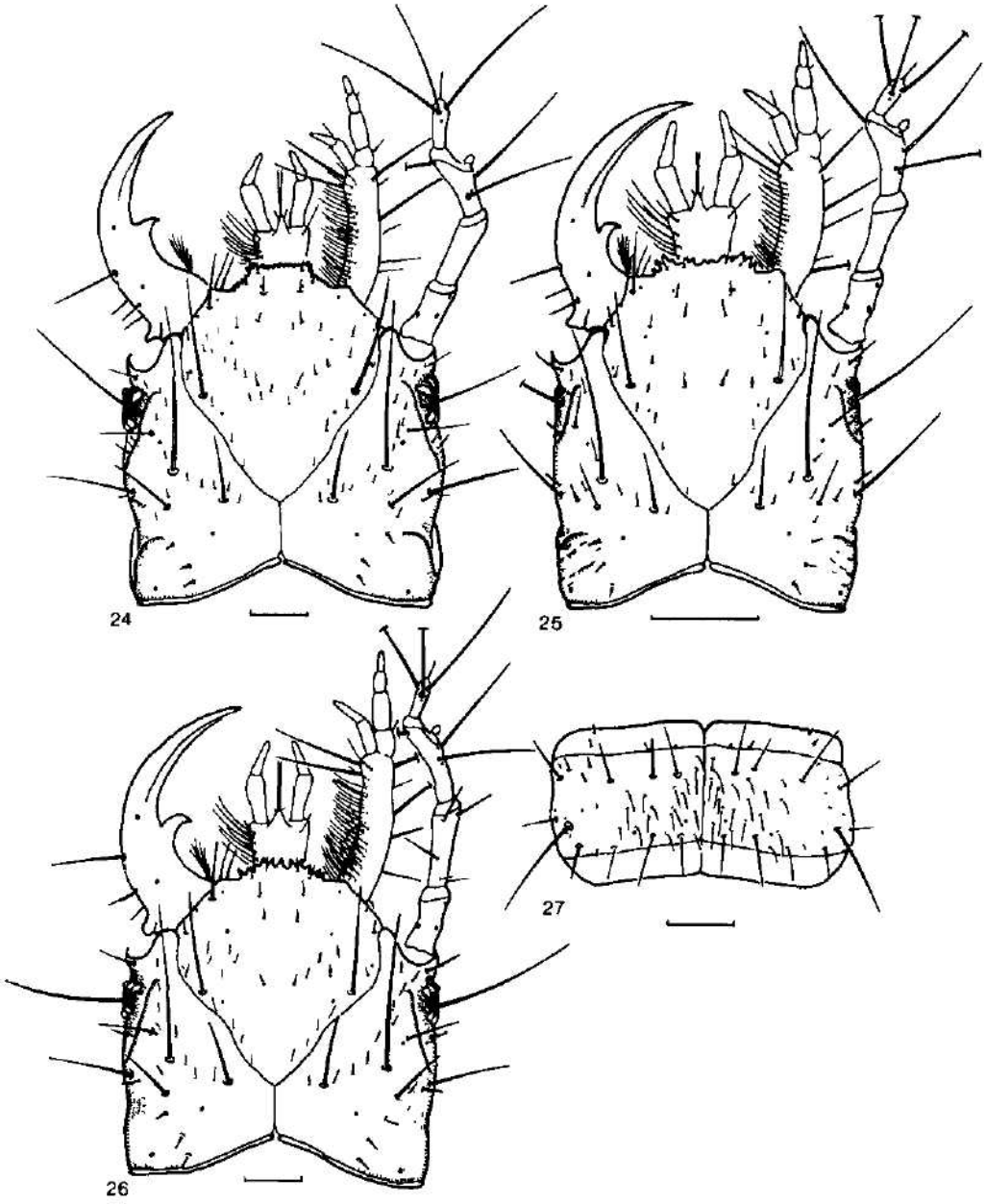
Genus *Thalassotrechus* Van Dyke, 1918
(Figs 6, 13, 16, 20)

Diagnosis. First-instar larvae of *Thalassotrechus* are unique among the species studied by the rounded lateral sides of the cephalic capsule, by the absence of cervical grooves; by the presence of egg-bursters on the parietale, by the absence of pore PR_h, by the short claw, by the position of the seta TA_1 which is at middle of the tarsus, and by the spindle-shaped setae TE_7 on tergites 1–8.

Description. **First instar larvae.** Cephalic capsule with rounded lateral sides (Fig. 6). Frontale without microsculpture (Fig. 6); nasale slightly protruding at middle (Fig. 13). Parietale with egg bursters consisting of one large tooth on each side near epicranial suture (Fig. 6); ocelli developed (Fig. 6); postocellar and cervical grooves absent (Fig. 6). Mandible without microdenticles between MN_b and MN_1; medial margin of terebra slightly convex near base (Fig. 6). Claw about 0.5× length of tarsus (Fig. 16). Urogomphi relatively long, divergent (Fig. 20).

Chaetotaxy: Length of seta AN_6 1/4–1/3 width of antennomere 4 (Fig. 6). Frontale with seta FR_6 spindle-shaped; seta EM_1 on prothorax spindle-shaped; length of setae MX_{11} and MX_{12} less than 0.25× diameter of maxillary palpomere 3. Pore PR_h on pronotum absent. Seta TA_1 located at middle of tarsus (Fig. 16). Setae TE_7 on tergites 1–8 spindle-shaped; seta PY_6 on pygidium normal, trichoid.

Second- and third-instar larvae. Unavailable. Superficially described by Moore (1956).



Figs 24–27 24–26, cephalic capsule, right antenna, left mandible, right maxilla, labium, L_3 (dorsal view): 24 – *Pogonus transfuga*, 25 – *Pogonistes angustus*, 26 – *Cardiaderus chloroticus* 27 – first abdominal segment of *Cardiaderus chloroticus*, L_1 (dorsal view) Scale bars = 0 2 mm

PHYLOGENETIC RELATIONSHIP Bousquet & Laplante (1997) indicate that adults of *T barbarae* possess several autapomorphies within the tribe Pogonini A similar statement could be made for the first instar larvae The presence of egg-bursters on the parietale, comparatively short seta AN_6, absence of pore PR_6, absence of cervical grooves, and spindle-shaped setae TE_7 are character states which are unique, and probably apomorphic, to *T barbarae* Relationships of the genus remain uncertain

MATERIAL STUDIED *Thalassotrechus barbarae* (G H Horn, 1892) $2L_1$ (mounted on slide) reared by W G Evans from adults collected at Pacific Grove, Monterey Bay, California (CNC)

GEOGRAPHICAL DISTRIBUTION AND DIVERSITY The genus *Thalassotrechus* includes a single species, *T barbarae*, from the Pacific coast of USA and Baja California, Mexico (Bousquet & Laplante 1997)

CONCLUDING REMARKS

In general, immature stages of most groups of carabids are poorly known and the tribe Pogonini is no exception Larvae of eleven species belonging to four genera were studied in the present paper, which account for only about 15% of the world fauna Larvae of seven genera (*Bedeliolus*, *Dioedercarus*, *Diplochaetus*, *Ochtozetus*, *Pogonopsis*, *Syrdenus*, *Olegius*) remain unknown We hope this modest contribution could stimulate others to study carabid larvae

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REFERENCES

ARNDT E 1991 Familie Carabidae (Coleoptera) Pp 45–141 In KLAUSNITZER B (ed) *Die Larven der Kafer Mitteleuropas* Band 1 Adephaga Goecke and Evers, Krefeld 273 pp

BOLDORI L 1936 Larve di Trechini VI *St Trentini Sci Natur* **17** 64–71

BOUSQUET Y 1985 Morphologie comparee des larves de Pterostichini (Coleoptera Carabidae) Description et tables de determination des espèces du Nord-Est de l'Amerique du Nord *Le Natur Can* **122** 191–251

BOUSQUET Y & GOULET H 1984 Notation of primary setae and pores on larvae of Carabidae (Coleoptera Adephaga) *Can J Zool* **62** 573–588

BOUSQUET Y & LAPLANTE S 1997 Taxonomic review of the New World Pogonini (Coleoptera Carabidae) *Can Entomol* **129** 699–731

EMDEN F I van 1942 A key to the genera of larval Carabidae (Coleoptera) *Trans R Entomol Soc Lond* **92** 1–99

ERWIN T L 1985 The taxon pulse a general pattern of lineage radiation and extinction among carabid beetles (Coleoptera Carabidae) Pp 437–472 In BALL G E (ed) *Taxonomy, phylogeny and zoogeography of beetles and ants* Junk Publisher Dordrecht, xii + 514 pp

ERWIN T L 1991 The ground beetles of Central America (Carabidae), part 2 Notiophilini, Loricerini, and Carabini *Smithsonian Contrib Zool* **501** 1–30

GREBENNIKOV V V 1996 Description of the first instar larva of Thalassophilus longicornis (Coleoptera Carabidae Trechodina) *Acta Soc Zool Bohem* **60**(4) 373–379

JEANNEL R 1941 Coleopteres Carabiques Premiere partie *Faune de France* **39** Paris 571 pp

JOHNS P M 1974 Arthropoda of the subantarctic islands of New Zealand (1) (Coleoptera Carabidae) Southern New Zealand, Patagonian, and Falkland Islands insular Carabidae *J R Soc New Zealand* **4** 283–302

KOMAROV E V 1996 A new genus and species of Carabidae (Coleoptera Carabidae) of the tribe Pogonini from Turkmenia *Russ Entomol J* **5** 31–33

KRYZHANOVSKIJ O L 1976 An attempt of a revised classification of the family Carabidae (Coleoptera) *Entomol Obozr* **55**(1) 80–91 (In Russian)

KRYZHANOVSKIJ O L 1983 *Coleoptera Vol 1, part 2 Beetles of the suborder Adephaga families Rhysodidae and Trachypachidae, family Carabidae (introduction and review of the USSR fauna)* Leningrad Nauka, 341 pp (In Russian)

LARSSON S G 1968 Løbebillernes larver Pp 282–433 In HANSEN V (ed) Biller XXIV Sandspringere og løbebiller (Cicindelidae og Carabidae) *Danmarks Fauna* 76 Kobenhavn Gads Forlag, 451 pp

LUFF M L 1985 The larvae of the British Carabidae (Coleoptera) VII Trechini and Pogonini *Entomol Gazette* **36**(4) 301–314

LUFF M L 1993 The Carabidae (Coleoptera) larvae of Fennoscandia and Denmark *Fauna Entomol Scand* **27** 1–187

MADDISON D R 1993 Systematics of the Holarctic beetle subgenus Bracteon and related Bembidion (Coleoptera Carabidae) *Bull Mus Comp Zool* **153** 143–299

MOORE I 1956 Notes on some Coleoptera with description of the early stages (Carabidae, Staphylinidae, Malachiidae) *Trans San Diego Soc Natur Histor* **12**(11) 207–230

MÜLLER G 1975 Zur Phylogenie der Bembidiini *Entomol Nachrich* **19**(1–2) 7–12

RAYNAUD P 1976 Stades larvaires de Coléoptères Carabiques *L Entomologiste* 32 71–82

REICHARDT H 1974 The South American Pogonini (Coleoptera Carabidae) *Papeis Avulsos de Zoologia* 27 279–286

SHAROVA I Kh 1958 The larvae of Carabidae beneficial and noxious to agriculture *Uchenye zapiski Moskovskogo Gosudarstvennogo Pedagogicheskogo Instituta imeni Lenina* 124 1–165 (In Russian)

SHAROVA I Kh 1964 Family Carabidae Pp 112–195 In GYLAROV M S (ed) *Opredelitel obitaushikh v pochve lichinok nasekomykh* Moscow Nauka Press, 919 pp (In Russian)

THOMPSON R T 1979 Larvae of North American Carabidae with a key to the tribes Pp 209–291 In ERWIN T L, BALL G E, WHITEHEAD D R W & HALPERN A L (eds) *Carabid beetles their evolution, natural history, and classification* The Hague Junk Publishers, 635 pp

WOMERSLEY H 1937 Coleoptera *British, Australian and New Zealand Antarctic Research Expedition Report* (B) 4(1) 23–36

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The dermestid beetles (Coleoptera: Dermestidae: Dermestinae) of Iran. Part 1: genus *Dermestes*

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Abstract. *Dermestes* (*Dermestinus*) *kafkai* sp. n. and *D.* (*D.*) *intermedius iranicus* ssp. n. from Iran are described and illustrated. *D.* (*D.*) *solskyi* Dalla Torre, 1911 is redescribed and illustrated. Distributional data to 18 *Dermestes* Linnaeus, 1758 species collected by three expeditions to Iran were undertaken by the Department of Entomology to the National Museum (Natural History) in Prague in 1970, 1973 and 1977 and further entomologists are given. A list of all so far known *Dermestes* species from Iran is compiled.

Taxonomy, new species, new subspecies, distribution, Coleoptera, Dermestidae, *Dermestes*, Palaearctic region

Some basic information about dermestid beetles from Iran were published in papers by Dalla Torre (1911), Lepesme (1946), Mroczkowski (1968), Sokolov (1972), Zhantiev (1976) and Lafer (1992).

Three expeditions to Iran were undertaken by the Department of Entomology to the National Museum (Natural History) in Prague in 1970, 1973 and 1977, respectivelly. The basic data about the expeditions, including detailed description of collecting localities (numbering successively), maps and photos can be found in Hoberlandt (1974, 1981, 1983). In this paper, the material of dermestid beetles genus *Dermestes* Linnaeus, 1758 (Coleoptera: Dermestidae: Dermestinae), is elaborated.

Recently some mainly Czech entomologists visited Iran, and an interesting material of *Dermestes* has been slowly accumulated. Although not very large, it contains a few rarely collected species with inadequatelly known ranges of distribution. An annotated list of findings is presented below.

Trough the text, the following abbreviations are used:
HNHM – Hungarian Natural History Museum, Budapest, Hungary (O. Merkl);
JHAC – Jiří Háva, Praha, Czech Republic;
MHNG – Muséum d' Histoire naturelle, Genève, Switzerland (I. Löbl);
MKAC – Marek Kafka, Neratovice, Czech Republic;
MMUE – Museum of Manchester University, Manchester, United Kingdom (C. Johnson);
NHMB – Naturhistorisches Museum, Basel, Switzerland (M. Brancucci);
NHMV – Naturhistorisches Museum, Wien, Austria (H. Schönmann);
NMPC – National Muzeum, Praha, Czech Republic (J. Jelínek);
SMNS – Staatliches Museum für Naturkunde, Sttutgart, Germany (W. Schawaller);
VKAC – Vladimír Kalík, Pardubice, Czech Republic;
ZMAS – Zoological Museum, Academy of Sciences, St. Peterburg, Russia (M. G. Volkovitsh).

Dermestes (*Dermestinus*) *coronatus* Steven in Schönherr, 1808

MATERIAL EXAMINED: Iran, Khorasan, E de Chaman Bid, 37° 26' N – 56° 37'E, 14.vii.1974, 3ex, A. Senglet lgt., V. Kalík det., MHNG; Iran, Mazanderan, O de Baladeh, 2500 m, 6.vii.1975, 1ex, A. Senglet lgt., V. Kalík det., MHNG.

DISTRIBUTION. Species known from south-eastern regions of European part of Russia, Caucasus, Turkey, Afghanistan, China: Xinjiang, India, from Iran without detailed data reported by Mroczkowski (1968) and Zhantiev (1976).

Dermestes (Dermestinus) frischii Kugelan, 1792

MATERIAL EXAMINED N Iran, Tehran, Darakeh, 16 v 1995, 5ex, M. Kafka lgt, J Háva det, JHAC, MKAC; SE Iran, Baluchistan, Bampur, 2–10 xi 1995, 5ex, M. Kafka lgt, J Háva det., JHAC; SE Iran, Baluchistan, Chabahar, 10 xi 1995, 31ex, on the dead *Caretta* sp, M Kafka lgt, J Háva det., JHAC, MKAC, N Iran, Mazandaran prov, Alborz Mts, 800 m, N slopes, Chalus env., 10.v.1996, 1ex, D Král lgt, J Háva det, JHAC, S Iran, Zagros Mts, Boyerahmad-va-Kuhgiluyeh pr, Kuh-e-Dinar ridge, 10 km NE of Yasul, 1800–2500 m, 1–2 v 1996, 1ex, D. Král lgt, J Háva det, JHAC, N Iran, Tehran pr, Veresk, 800 m, Reshtche Kuhhaye Alborz, 2 viii.1970, 4ex, exp Nat Mus, V Kalík det, NMPC, NW Iran, Azarbaygan, Kivi Bala, 21 km W of Khalkhal, 1500 m, 16 viii 1970, 5ex, exp Nat Mus, V Kalík det, NMPC; N Iran, Tehran-Evin, 1700–2000 m, 9–10.iii, 14 iii and 16 iii 1973, 2ex, exp Nat Mus, V Kalík det, NMPC; SE Iran, Baluchistan, 15 km NE of Bandar-e Chah Bahar, 5 iv 1973, 1ex, exp Nat Mus, V Kalik det, NMPC, SE Iran, Baluchistan, Bandar-e Chah Bahar, 5–6 v 1973, 3ex, exp Nat Mus, V Kalik det, NMPC; SE Iran, Baluchistan, Tis, 6–7.iv.1973, 2ex, exp Nat Mus, V Kalík det, NMPC; SE Iran, Baluchistan, 9 km S of Espakeh, 10 iv 1973, 1ex, exp. Nat Mus, V. Kalik det, NMPC; SE Iran, Baluchistan, Deh Pabid, vicinity on the road between Khash and Zahedan, 21.iv 1973, 2ex, exp Nat Mus, V Kalík det., NMPC; C Iran, Esfahan prov, 30 km S of Robate Tork, 24 vi.1973, 5ex, exp Nat Mus., V Kalík det, NMPC, S Iran, Fars, Dasht-e Arzhan, 54 km E of Kazerun, 1700 m, 9.vi.1973, 1ex, exp Nat. Mus, V Kalík det, NMPC; NW Iran, East Azarbaygan, 30 km NW of Mianch, 5 vii 1973, 35ex, exp. Nat. Mus, V Kalik det, NMPC, NW Iran, East Azarbaygan, Basmenj, 19 km SE of Tabriz, 27.iii.1977, 2ex, exp. Nat Mus., V Kalik det, NMPC; S Iran, Fars, Khormuj, 20 iv 1977, 24ex, exp Nat Mus, V. Kalík det., NMPC, Iran, Elburs, Geb Masandaran, Kojur, an der Strasse südl Alamdeh, 1540 m, Strokken, 27 v.–31 v.1978, 5ex, Martens & Pieper lgt, J Hava det, SMNS; Iran, Golhak bei Teheran, iii–v.1961, 33ex, J Klapperich lgt., V Kalík det, MHNG, VKAC, NMPC, C Iran, p. Fars, Yasug NV, Siraaz (vill. Kakan), 3040N 5143E, 13 vi 1999, 3ex, P. Kabátek lgt, JHAC

DISTRIBUTION. Cosmopolitan species (Lepesme 1946, Mroczkowski 1968, Zhantiev 1976, Lafer 1992). First record from Iran.

Dermestes (Dermestinus) intermedius iranicus ssp. n.
(Fig. 3)

TYPE MATERIAL **Holotype** (male): Iran, Lorestan, Ma Amulan, 6 viii.1973, 33 20'N – 47 54'E, A Senglet lgt, V Kalík det 1979, MHNG. **Allotype** (female). Iran, Bakhtiyari, Kuhrang, 19 vi 1974, A Senglet lgt, V Kalík det 1979, MHNG **Paratypes** Iran, Bakhtiyari, Kuhrang, 19 vi.1974, 1male/1 female, A. Senglet lgt, V Kalik det 1979, MHNG,VKAC, Iran, Azarbaygan, N de Bonab, 4 vi 1975, 1 male/1 female, A. Senglet lgt., V Kalik det 1979, MHNG, Iran, Gilan, Umg Damash, S Langerud, 2000 m, 17 viii1975, Hinz lgt, 1 female, J Háva det, JHAC, Iraq, Baghdad, coll Kálalova, Paratype *D intermedius* ssp ? Kalik det. 1950, 3 male/1 female, Kalik det 1979, NMPC, VKAC, JHAC; Iraq, Baghdad, V. Kalik det. 1980, MMUE

DIFFERENTIAL DIAGNOSIS. The new subspecies differs from the nominotypical one by narrower body (length: 6–6.7 mm, width: 2.7–3.2 mm), by the pubescence of the body, which is black mixed with sparse pale one, not creating any spots. The aedeagus of the new subspecies is slightly vaulted with small point on inner side of the apical third as (Fig. 3) while it is regulary rounded all along its length in the nominotypical subspecies, as in Figs 1–2). All other morphological characters are the same as in the nominotypical subspecies.

DISTRIBUTION. Iran, Iraq.

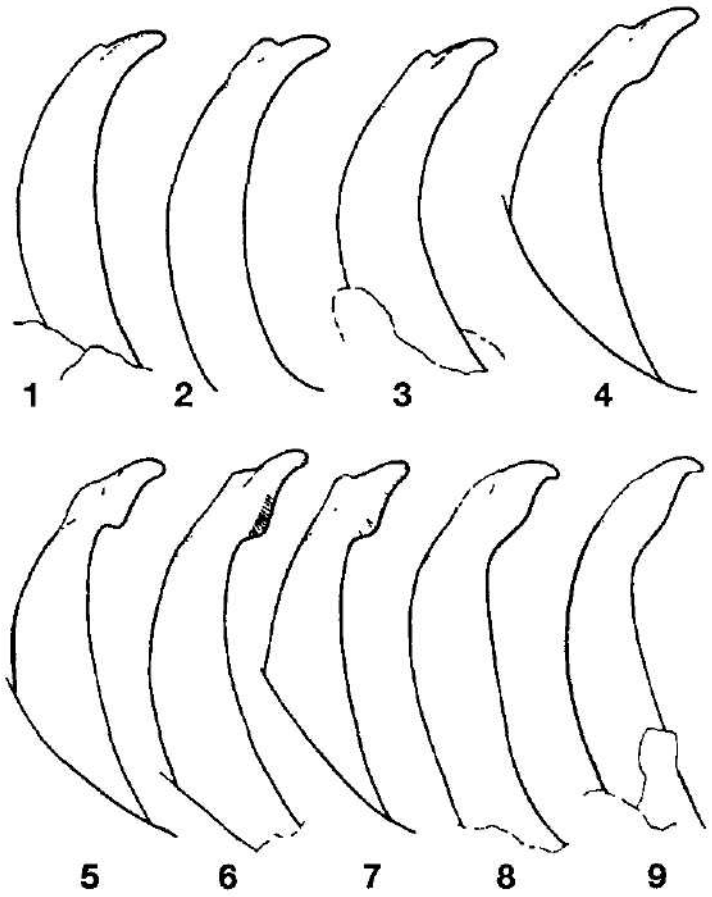
NAME DERIVATION. Named after to its occurrence in Iran.

REMARKS. Kalík (1951) mentioned 4 specimens of Iraq, Baghdad, Kálalová lgt as "Paratypus *Dermestes intermedius* ssp ?" The additional more numerous material, which is now at the authors disposal, allows to describe the new subspecies.

Dermestes (Dermestinus) kafkai sp. n.
(Figs 10–12)

TYPE MATERIAL **Holotype** (male) N Iran, Chalus – Karaj, Marzan Abad, 3000 m, 18 VI 1997, M Kafka lgt Holotype deposited in JHAC

DESCRIPTION Male Body black, oval, convex Body length 7 2 mm Body width 3 1 mm Cuticle black, colouring of body surface by dense, coloured pubescence Head brown-orange hairs, antenna reddish brown, with eleven segments, antennal club from three last segments Pronotum brown-orange with intermixed black hairs, punctured more closely Scutellum triangular, with white pubes-



Figs 1–9 Male genitalia laterally view of median lobe 1–2 *Dermestes (Dermestes) intermedius intermedius* Kalik (Hungaria), 3 *D (D.) intermedius iranicus* ssp n (Iran), 4–7 *D (D.) kaszabi* Kalik (Dalmatia, Caucasus), 8–9 *D (D.) mustelinus* Erichson (France)

cence. Elytra with wide white basal transverse band, each elytron with black spot near scutellum; posterior part of elytrae uniformly black. Legs reddish brown with yellow pubescence. Ventral part of body densely covered with white and black pubescence. Abdominal sternites with exception of the last one (Fig. 10) white, each with clearly delimined triangular black spot laterally and with two small black spots posteriorly. Sternite IV medialy each without a group of erected white setae, oriented posteriad. Last sternite black with two small white spots on anterior margin and with long, yellow hairs on posterior margin. Aedeagus as in (Fig. 12).

Female unknown.

DIFFERENTIAL DIAGNOSIS. *Dermestes* (*D.*) *kafkai* sp. n. is habituall, especialy in the shape and setation of pronotum, elytra and abdomen very similar to *D.* (*D.*) *elegans* Gebler, 1830 and *D.* (*D.*) *solskyi*. Main morphological differences are shown in the table.

Species	*D. kafkai* sp. n.	*D. elegans*	*D. solskyi*
head	brown-orange hairs	brown-orange with mixed white and black hairs	yellow hairs
pronotum	brown-orange with intermixed black hairs	brown-orange with intermixed black and white hairs	yellow-orange with intermixed black hairs
elytron	only one black spot near scutellum (Fig. 11) in basal white band, basal white band reaching elytral midlength	two black spots (scutellar and humeral – Fig. 14) in basal white band; basal white band reaching elytral midlength	no black spots in basal yellow band, basal yellow band (Fig. 17) in basal third of elytra
abdomen	last sternite black with two small white spots anteriorly (Fig. 10), and with long yellow hairs on hind margin	last sternite black with white pattern (Fig. 13) and with black hairs on posterior margin	last sternite black without white spots (Fig. 16), and with long yellow hairs on posterior margin
aedeagus	paramera in lateral view narrower, median lobe less strongly curved, with obtuse apex (Fig. 12)	paramera in lateral view broader, median lobe more strongly curved, almost sharp apex (Fig. 15)	paramera in lateral view broader, median lobe more strongly curved than in *D. elegans* (Fig. 18)

DISTRIBUTION. N Iran.

NAME DERIVATION. Delicated to its collector Marek Kafka, specialist in the family Buprestidae.

Dermestes (*Dermestinus*) *kaszabi* Kalík, 1951

MATERIAL EXAMINED Iran, Azarbaygan, Kalah Arasbaran Wildlife Refuge, 2400–2650 m, 6–10 vi 1978, 2ex, Martens & Pieper lgt., J. Háva det., SMNS, VKAC, Iran, Azarbaygan, Hero Abad, 10.viii 1974, 1ex, A. Senglet lgt., V. Kalik det., MHNG, Iran, Bakhtiari, barrage de Kuhrang, 18 vi 1974, 1ex, A. Senglet lgt., V. Kalik det., MHNG, Iran, Detendere, 2300 m, 24 iv 1970, 1ex, Wittmer & Böthmer lgt., V. Kalik det., NHMB

DISTRIBUTION. Species known from Slovakia, Hungary, Romania, Bulgaria, Greece, Dalmatia, Croatia, Bosnia-Herzegovina, Montenegro, Turkey, Caucasus, Armenia, and Armenia (Háva 1999). First record from Iran.

Dermestes (*Dermestinus*) *maculatus* DeGeer, 1774

MATERIAL EXAMINED N Iran, Tehran, Darakch, 16 v 1995, 1ex, M. Kafka lgt., J. Háva det., JHAC, W Iran, Azarbaygan, Bastam, 1270 m, 30.ix–1x.1998, 1ex, P. Kabátek lgt., J. Háva det., JHAC, Iran, Sabzvaran, südl. Bam, iii 1950, Löffler lgt., Österreichische Iran-Expedition 1949/1950, 1ex, V. Kalík det., NHMV

DISTRIBUTION. Cosmopolitan species (Lepesme 1946, Mroczkowski 1968, Zhantiev 1976, Lafer 1992). First record from Iran.

Dermestes (Dermestinus) murinus murinus Linnaeus, 1758

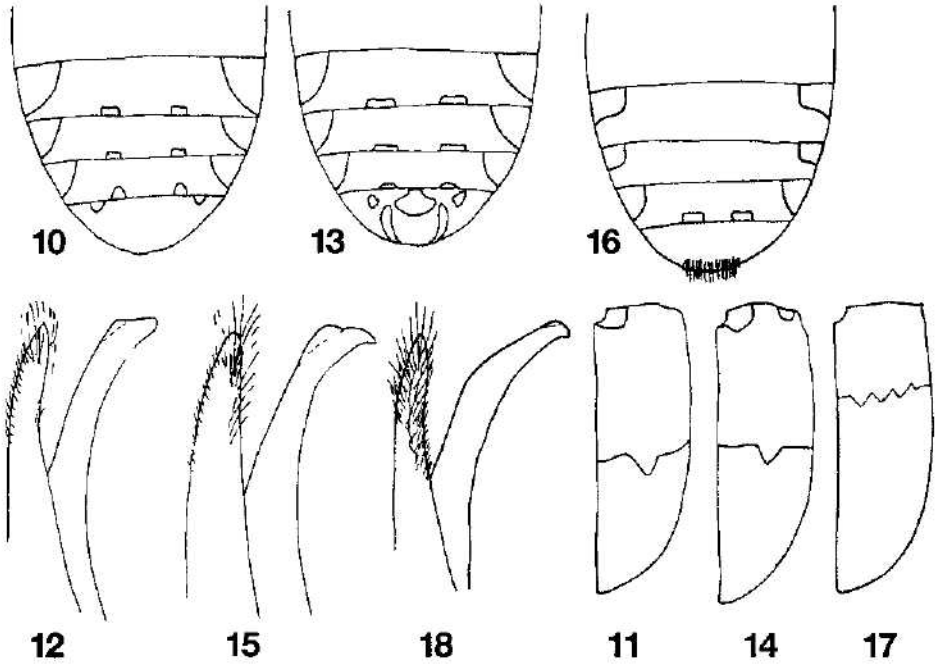
Material examined N Iran, Gilan, Sheykh Mahalleh (Assalem), 160 m, 28 vi – 3 vii 1977, 1ex, exp Nat Mus , V Kalik det , NMPC, N Iran, Marandaran p , Nahav, Honzu 10 km S Gazan, 36 45N 5428E, 15 vi.1999, 5ex, on the dry mushrooms, M Rejzek lgt , J Háva det , JHAC

Distribution The species distributed in the Palaearctic region (Lepesme 1946, Mroczkowski 1968, Zhantiev 1976, Lafer 1992). First record from Iran.

Dermestes (Dermestinus) sardous sardous Küster, 1846

Material examined Iran, Khouzestan, Masdjed Soleyman, 20 v 1974, 3ex, A Senglet lgt , V Kalik det , VKAC, W Iran, Lorestan prov,. 10 km W of Babazaid between Malavi and Pol-e Dochtar, 880 m, 9–10 iv 1977, 1ex, exp Nat Mus , V Kalik det , NMPC, Iran, Kohkilayeh, route de Charam, 22 v.1974, 2ex, A Senglet lgt., V Kalik det., MHNG, Iran, Fars, Bishapour, 28 v 1974, 1ex, A Senglet lgt , V Kalik det , MHNG, Iran, Khouzestan, Masdjed Soleyman, 20 v 1974, 1ex, A Senglet lgt , V. Kalik det , MHNG

Distribution. The species distributed in the Mediterranean (Lepesme 1946, Mroczkowski 1968, Zhantiev 1976, Lafer 1992). First record from Iran.



Figs 10–18 Figs 10, 13, 16 – ventraly view of abdomen 10 – *Dermestes (D) kafkai* sp n , 13 – *D (D) elegans* Gebler, 16 – *D (D) solskyi* Dalla Torre Figs 11, 14, 17 – dorsaly view of elytra 11 - *Dermestes (D) kafkai* sp n , 14 – *D (D) elegans* Gebler, 17 – *D (D) solskyi* Dalla Torre Figs 12, 15, 18 – male genitalia lateraly view of one paramere and median lobe 12 – *Dermestes (D) kafkai* sp n , 15 – *D (D) elegans* Gebler, 18 – *D (D) solskyi* Dalla Torre.

Dermestes (*Dermestinus*) *sibiricus* Erichson, 1846

MATERIAL EXAMINED N Iran, Chalus Karaj, Marzan Abad, 3000 m, 18 vi 1997, 2ex, M Kafka lgt , J Háva det , JHAC, S Iran, Zagros Mts , Boyerahmad-va-Kuhgiluyeh pr , Kuh-e-Dinar ridge, 10 km NE of Yasuj, 1800–2500 m, 1–2-v 1996, 1ex, D Král lgt , J. Háva det., JHAC; C Iran, 30 km S of Robate Tork, Esfahan Prov , 24–25 vi 1973, 14ex, exp. Nat. Mus , V Kalík det , NMPC, Iran, 30 km S of Robate Tork, 24 vi 1973, 1ex, V Kalík det., SMNS

DISTRIBUTION. Species known from Caucasus, Turkey, Middle Asia, Kazakhstan, Uzbekistan, Turkmenistan, Siberia, northern China and Mongolia (Lepesme 1946, Mroczkowski 1968, Zhantiev 1976, Lafer 1992). First record from Iran.

Dermestes (*Dermestinus*) *solskyi* Dalla Torre, 1911
(Figs 16–18)

Dermestes ratus Solsky, 1876 269 nec *D ratus* LeConte, 1854: 108.

TYPE MATERIAL EXAMINED Holotype by present designation, labelled *Dermestes ratus mihi* // Shachruda Persia // G Kristophom kol Solskovo //; ZMAS

ORIGINAL DESCRIPTION. "Dermestes ratus mihi (female): elongato-ovalis, cylindricus, niger, subopacus, subtilissime ruguloso-punctulatus, capite, thorace elytrisque basi late fulvo-cinereo, maculatim tomentosis, elytris pone basin nigro-pubescentibus. Scutello albotomentoso. Antennis piceis, clava ferruginea. Subtus dense albo-tomentosus, abdomine lateribus nigro-maculato, segmento ultimo toto nigro, fulvo-cinereo pubescente, coxis trochanteribusque albis. Long. 7 (elytr. 5), lat. 3 mm."

REDESCRIPTION. Male. Body black, oval, convex. Body length 7 mm. Body width 3 mm. Cuticle black, colouring of body surface by dense, coloured pubescence. Head with yellow hairs, antenna reddish brown, with eleven segments, antennal club from three last segments. Pronotum yellow-orange with intermixed black hairs, punctured more closely. Scutellum triangular, with white long pubescence. Elytra with wide yellow basal transverse band, each elytron without black spot near scutellum; posterior part of elytrae uniformly black (Fig. 17). Legs reddish brown with yellow pubescence Ventral part of body densely covered with white and black pubescence. Abdominal sternites with exception of the last one (Fig. 16) white, each with clearly delimined triangular black spot laterally and with two small black spots posteriorly. Sternite IV medialy each without a group of erected white setae, oriented posteriad. Last sternite black without small white spots on anterior margin and with long, yellow hairs on posterior margin. Aedeagus as in (Fig. 18).

Female unknown.

DIFFERENTIAL DIAGNOSIS. *Dermestes* (*D.*) *solskyi* is habitually very similar to *D.* (*D.*) *elegans* and *D* (*D.*) *kafkai* sp. n. Main morphological differences are shown in the table of the *D.* (*D.*) *kafkai* sp. n

REMARKS. Species known only from the holotype (Dalla Torre 1911, Lepesme 1946, Mroczkowski 1968).

Dermestes (*Dermestinus*) *undulatus* Brahm, 1790

MATERIAL EXAMINED S Iran, Zagros Mts., Boyerahmad-va-Kuhgiluyeh pr, Kuh-e-Dinar ridge, 10 km NE of Yasuj, 1 2 v 1996, 2 1ex, D Král lgt , J Háva det , JHAC, NW Iran, Azarbaygan, Kivi Bala, 21 km W of Khalkhal 1500 m, 16 viii 1970, 5ex, exp Nat. Mus , V Kalík det , NMPC, C Iran, p Fars, Yasug NV, Siraaz (vill. Kakan), 3040N 5143E, 13 vi 1999, 1ex, P Kabátek lgt , J Háva det , JHAC.

DISTRIBUTION. The species distributed in Holarctic region, from Iran without detailed data reported by Lepesme (1946), Mroczkowski (1968), Zhantiev (1976), and Lafer (1992).

Table 1 Species of *Dermestes* listed from Iran (following abbreviations used D – Dalla Torre, L – Lafer, M – Mroczkowski S – Sokolov Z – Zhantiev, HK – this paper)

species reference (s)	
Dermestes (*Dermestinus*) *coronatus* Steven, 1808	S 1972, HK
Dermestes (*Dermestinus*) *frischii* Kugelan, 1792	HK
Dermestes (*Dermestinus*) *gyllenhali gyllenhali* Castelnau, 1840	M 1968
Dermestes (*Dermestinus*) *intermedius iranicus* ssp n	HK
Dermestes (*Dermestinus*) *kafkai* sp n	HK
Dermestes (*Dermestinus*) *kaszabi* Kalik, 1951	HK
Dermestes (*Dermestinus*) *maculatus* DeGeer, 1774	HK
Dermestes (*Dermestinus*) *murinus murinus* Linnaeus, 1758	HK
Dermestes (*Dermestinus*) *sardous sardous* Kuster, 1846	HK
Dermestes (*Dermestinus*) *sibiricus* Erichson, 1846	HK
Dermestes (*Dermestinus*) *solskyi* Dalla Torre, 1911	D 1911, M 1968, Z 1976, L 1992, HK
Dermestes (*Dermestinus*) *undulatus undulatus* Brahm, 1790	M 1968, Z 1976, L 1992, HK
Dermestes (*Dermestes*) *ater* DeGeer, 1774	M 1968, Z 1976, HK
Dermestes (*Dermestes*) *bicolor* Fabricius, 1781	HK
Dermestes (*Dermestes*) *fuliginosus* Rossi, 1792	HK
Dermestes (*Dermestes*) *lardarius* Linnaeus, 1758	HK
Dermestes (*Dermestes*) *leechi* Kalik, 1952	HK
Dermestes (*Dermestes*) *olivieri* Lepesme, 1939	Z 1976, L 1992, HK

Dermestes (*Dermestes*) *ater* DeGeer, 1774

MATERIAL EXAMINED SE Iran, Baluchistan, Chabahar env, 10 xi 1995, 1 ex on the dead *Caretta* sp, M Kafka lgt, J Hava det, JHAC, S Iran, Hormozgan, Bagh-e Tang, 6 km W of Genu, 410 m, 7–9 v 1977, 1ex, exp Nat Mus, V Kalik det, NMPC

DISTRIBUTION Cosmopolitan species, from Iran without detailed data reported by Mroczkowski (1968), Zhantiev (1976).

Dermestes (*Dermestes*) *bicolor* Fabricius, 1781

MATERIAL EXAMINED SE Iran Baluchistan, Tis, 6–7 iv 1973, 1ex, exp Nat Mus, V Kalik det, NMPC, Iran, Mordab, 28 x 1954, 1 ex, F Schanffele lgt, V Kalik det, SMNS, Iran Baluchistan, Iranshar, 800 m, 11–18 iii 1954, 1ex, Richter & Schanffele lgt, V Kalik det, SMNS, Iran, Golhak bei Teheran, 1400 m, vi–viii 1961, 1ex, J Klapperich lgt, V Kalik det, HNHM

DISTRIBUTION The species distributed in the Palaearctic region (Lepesme 1946, Mroczkowski 1968, Zhantiev 1976, Lafer 1992) First record from Iran

Dermestes (*Dermestes*) *fuliginosus* Rossi, 1792

MATERIAL EXAMINED Iran, Dekendera, 2300 m, 24 4 1970, 1ex, Wittmer & Boethmer lgt, V Kalik det, NHMB

DISTRIBUTION. Species distributed in central and southern Europe, Turkey and Caucasus (Lepesme 1946, Mroczkowski 1968, Zhantiev 1976, Lafer 1992). First record from Iran

Dermestes (*Dermestes*) *lardarius* Linnaeus, 1758

MATERIAL EXAMINED N Iran, Tehran env, 26 vi 1996, 1ex, J Háva det, JHAC, N Iran, Khwoy, vi 1902, 1ex, C & O Vogt lgt, V Kalik det, VKAC

DISTRIBUTION Cosmopolitan species (Lepesme 1946, Mroczkowski 1968, Zhantiev 1976, Lafer 1992) First record from Iran

Dermestes (Dermestes) leechi Kalík, 1952

MATERIAL EXAMINED Persien, Sistan, 10 IV 1950, 2ex, coll Scharif, V Kalik det, NHMB

DISTRIBUTION Species known from India, Turkmenistan, Uzbekistan, Pakistan, Tadzhikistan, Morocco, Egypt, Sebair Isl, W of Hoddeida in the S Red Sea, Spain, Sudan (Adams 1980, Háva 1999) First record from Iran

Dermestes (Dermestes) olivieri Lepesme, 1939

MATERIAL EXAMINED N Iran, Chalus Karaj, Marzan Abad, 2000 m, 18 VI 1997, 4ex M Kafka lgt, J Hava det, JHAC, MKAC, Iran, Azarbaygan, Kalh, Arasbaran, 2400–2650 m, 25 V 1978, 2ex, Martens & Pieper lgt, J Hava det, SMNS Iran, Ala-Dagh, Budschnurd, 1033 m, V 1902, 2ex, coll Hauser, J Hava det, NMPC

DISTRIBUTION The species distributed in southern and Central Europe, Caucasus, Turkey, Turkmenistan and Syria, from Iran reported by Lepesme (1946), Mroczkowski (1968), Zhantiev (1976), Lafer (1992)

Acknowledgements

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REFERENCES

ADAMS R G 1980 Dermestes leechi Kalik in stored products and new diagnostic characters for Dermestes spp (Coleoptera Dermestidae) *J Stored Prod Res, London* **16** 119–122

DALLA TORRE K W 1911 Dermestidae Pp 39–96 In SCHENKLING S (ed) *Coleopterorum Catalogus, Pars 33* Berlin W Junk, 96 pp

HAVA J 1999 Contribution to the knowledge of the Old World Dermestidae (Coleoptera) Part I Genus Dermestes *Fol Heyrovskyana* **7** 133–140

HOBERLANDT L 1974 Results of the Czechoslovak-Iranian entomological expedotion to Iran 1970 No I Introduction *Acta Entomol Mus Natl Prague*, Suppl **6** 9–20

HOBERLANDT L 1981 Results of the Czechoslovak-Iranian entomological expeditions to Iran Introduction to the Second expedition 1973 *Acta Entomol Mus Natl Prague* **40** 5–32

HOBERLANDT L 1983 Results of the Czechoslovak-Iranian entomological expeditions to Iran Introduction to the Third expedition 1977 *Acta Entomol Mus Natl Prague* **41** 5–24

KALIK V 1951 [Notes sur quelques especes et formes du Genre Dermestes L] *Entomol Listy* **14** 39–46 (in Czech)

LAFER G S 1992 [*Keys to the identification of insects of the Far East of the USSR, vol 3, Coleoptera 2*] Skt Peterburg Nauka, 704 pp (in Russian)

LEPESME P 1946 Revision des Dermestes (Coleoptera, Dermestidae) *Ann Soc Entomol Fr* **115** 37–68

MROCZKOWSKI M 1968 Distribution of the Dermestidae (Coleoptera) of the world with a catalogue of all known species *Ann Zool* **26** 15–191

SOKOLOV E A 1972 [Materials to fauna and ecology of skin-eater-beetles (Coleoptera, Dermestidae) of Kazakhstan] *Trudy Kazakh Nauch -issledov Inst Zashch Rast* **11** 115–137 (in Russian)

SOLSKY S M 1876 [Beetles (Coleoptera), fourth volume] In Fedochenko A P (ed) *Puteshestvie v Turkestan, t 2, ish 5 tetr 2* S-Peterburg, Moskva Izd Imp Obshtsh Lyub Yest Antrop Etnogr (in Russian)

ZHANTIEV R D 1976 *The skin eaters – family Dermestidae of fauna of the USSR* Moscow Izd Mosk Univ, 180 pp (in Russian with English summary)

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Classification of the *Amara* (*Amara*) *communis* species aggregate based on the egg and larval stage characters (Coleoptera: Carabidae: Amarina)

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Abstract The superficial chorion structure and three larval instars of *Amara* (*Amara*) *communis* (Panzer, 1797) *A* (*A*) *convexior* Stephens 1828, *A* (*A*) *makolskii* Roubal, 1923 and *A* (*A*) *pulpani* Kult, 1949 reared ex ovo are described and illustrated Differential diagnosis of the *A communis* species aggregate, based on larval characters, is given The keys to the species of the *A communis* species aggregate are provided, separately for the first instar larvae, and for the second+third instar larvae The specific status of all four mentioned species is corroborated *A convexior* and *A pulpani* are considered more derived *A communis* and *A makolskii* are closely related

Taxonomy, larval taxonomy, classification, keys, egg chorion structure, Coleoptera, Carabidae, *Amara communis* species aggregate, *A. convexior*, *A makolskii*, *A. pulpani*, Palaearctic Region

INTRODUCTION

In the adult stage the *Amara* (*Amara*) *communis* species aggregate is characterized by the combination of the following features scutellar stria present, scutellar setiferous puncture absent, setiferous puncture at pronotal posterior angle well removed from lateral bead, separated from it by distance at least equal to width of setiferous puncture; elytral striae deepened and widened apicad, usually entire antennomere 2 or at least its two thirds dorsally pale red-brown, antennomere 3 to great extend pale red-brown (Hůrka 1996) The aggregate consists of four species *A communis* (Panzer, 1797), *A convexior* Stephens, 1828, *A makolskii* Roubal, 1923 (= *A pseudocommunis* Burakowski, 1957) and *A pulpani* Kult, 1949 The specific status of *A convexior* has been acknowledged since a long time The differentiation of all four species in the adult stage was provided by e g , Gersdorf & Kuntze (1957) and by Hůrka 1996

The aim of this paper is (1) to found specific differential characters also in the preimaginal stages, and (2) to determine the differential diagnosis of the *A communis* species aggregate in the larval stage The differential diagnosis of the subgenus *Amara* Bonelli in the larval stage was published by Hůrka (1998) Scanty structural characters and morphometric data on larvae of *A communis* and *A convexior* were given by Arndt (1991) and Luff (1993), Burakowski (1967) provided some data on morphology and bionomy of the preimaginal stages of *A makolskii* In the paper by Luff (1981) some metric features of the *A communis* egg are given

MATERIAL AND METHODS

All four species are reared in the laboratory conditions according to the technique described by Hůrka (1996) The material of eggs (E) and of all three larval instars (L_1, L_2, L_3), reared ex ovo, are available for taxonomic study *A communis* – 2 E, 12 L_1, 8 L_2, 17 L_3, *A convexior* – 3 E, 8 L_1, 6 L_2, 10 L_3, *A makolskii* – 1 E, 3 L_1, 2 L_2, 3 L_3, *A*

pulpani – 3 E, 7 L_1, 11 L_2, 17 L_3. The parental pairs are found as follows: *A. communis* – Slovakia or., Latorica River, Bol (code of mapping square 7596[1]), flood debries, 11. iv. 1987, J. Růžička & A. Růžičkova leg., Bohemia bor or., Vrchlabí (5359), 20. iv. 1997, P. Saska leg., *A. convexior* – Bohemia centr., Nové Mlýny pr. Vlašim (6255), 30. iii. 1986, Bohemia centr., Praha-Haje (5952), 16. iv. 1986, J. Růžička leg., Bohemia centr., Praha-Troja, Havránka (5852), 23. iv. 1993, Bohemia centr., Praha-Čimice (5852), 27. iv. 1996, 19. iv. 1997, K. Hůrka leg., *A. makolskii* – Bohemia occ., peat bog Soos (5840), 14. iv. 1987, J. Hejkal leg., *A. pulpani* – Bohemia occ., Kraslice, Tisovec (5641), heath, 2. iv. 1987, 19. iv. 1990, J. Hejkal leg., Bohemia occ., Kraslice, Šibeniční vrch (5641), heath, 16. v. 1989, 23. iv. 1995, J. Hejkal leg.

For comparative purpose larvae of ten other species of the nominotypical subgenus *Amara* Bonelli, 1810, *A.* (*Amaroceliа*) *erratica* (Duftschmid, 1812), six species of the subgenus *Celia* Zimmermann, 1832, *A.* (*Paracelia*) *quenseli quenseli* (Schonherr, 1806), *A.* (*Percosia*) *equestris equestris* (Duftschmid, 1812), five species of the subgenus *Bradytus* Stephens, 1823 and three species of the subgenus *Curtonotus* Stephens, 1828 have been studied. All larvae are deposited in the Collectio Hůrka, Department of Zoology, Charles University Praha.

The notation of setae and pores follows the papers by Bousquet & Goulet (1984) and Bousquet (1985).

Micrographs were obtained using a Tesla BS 300 model scanning electron microscope.

DESCRIPTIONS

Amara (*Amara*) *communis* (Panzer, 1797)
(Figs 1, 2, 9–19)

Colour. Head yellow-brown, thoracic and abdominal terga yellow-brown to brown-gray.

Egg. Chorion structure with almost round pores, without marginal projections (Figs 1, 2).

Larval stage: Third instar. Head: cephalic capsule transverse (index width/length = 1.45–1.56), sides slightly convex; cervical grooves distinct, reaching space between PA_3 and PA_5 dorsally and almost reaching PA_{15} ventrally; coronal suture nearly as long as the length of antennomere IV (0.92–1.08, aver. 0.98, n=17), nasale with six large, nearly equally spaced teeth (Figs 14, 15); mandibles with one longer and 0–2 small secondary setae, antennomere I with one slight secondary seta, labial palpomere I without secondary seta; width of head capsule 1.15–1.30 (aver. 1.21, n=17) mm (Arndt 1991: 0.95–1.11 mm). Thorax: femora with 4–7 spiniform secondary setae. Abdomen: terga I–IV in anterior row with distinct setae TE_1, TE_6, TE_7, in posterior row with long seta TE_9 and TE_{10}, TE_α slight (Fig. 18), urogomphi slightly longer than width of tergum IX (1.05–1.25, aver. 1.15), with four strong secondary setae, UR_α absent, UR_β at most half as long as UR_γ (aver. 0.38, n=15) (Fig. 19).

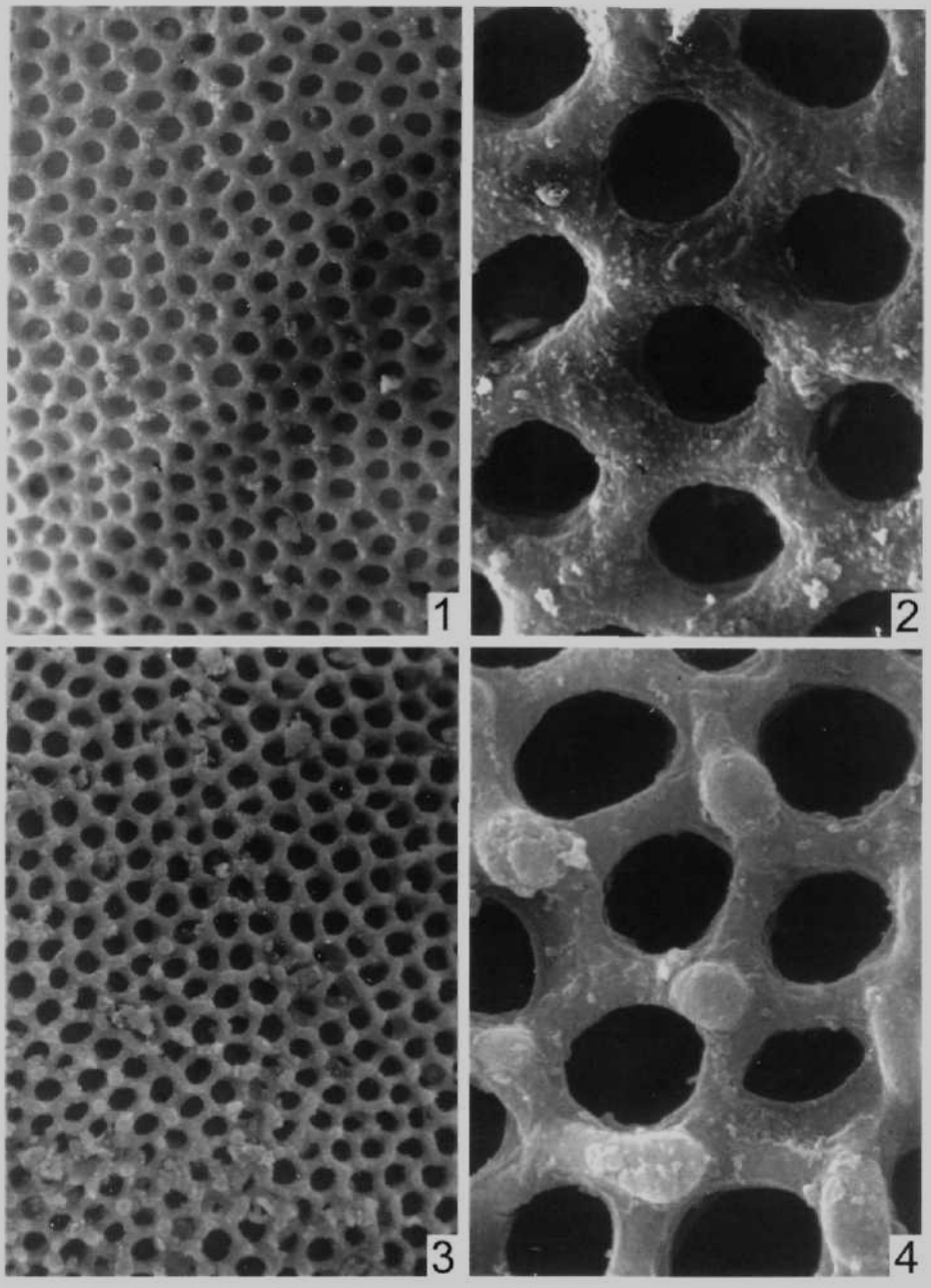
Second instar. Head: index width/length = 1.43–1.54; coronal suture as long as about three fourth to four fifths of the length of antennomere IV (0.70–0.90, aver. 0.77, n=7); antennomere I without secondary seta, antennomere II with only one secondary seta; width of head capsule 0.80–1.00 (aver. 0.92, n=8) mm (Arndt 1991: 0.71–0.74 mm). Thorax: femora with 4–5 spiniform secondary setae.

First instar. Head: index width/length = 1.32–1.50; egg burster forming a ridge composed of very small, blunt teeth, more spaced proximad, reaching base of FR_2, PA_4 petty (Fig. 9); coronal suture as long as two thirds or three fourth of antennomere IV length (0.67–0.75), width of head capsule 0.68–0.74 (aver. 0.71, n=12) mm (Arndt 1991: 0.51–0.54 mm). Abdomen: tergal setae of the posterior row ($TE_{9, 10}$) at least six times as long as setae of the anterior row (TE_7) (Fig. 17), urogomphi 1.20–1.45 times as long as width of tergum IX.

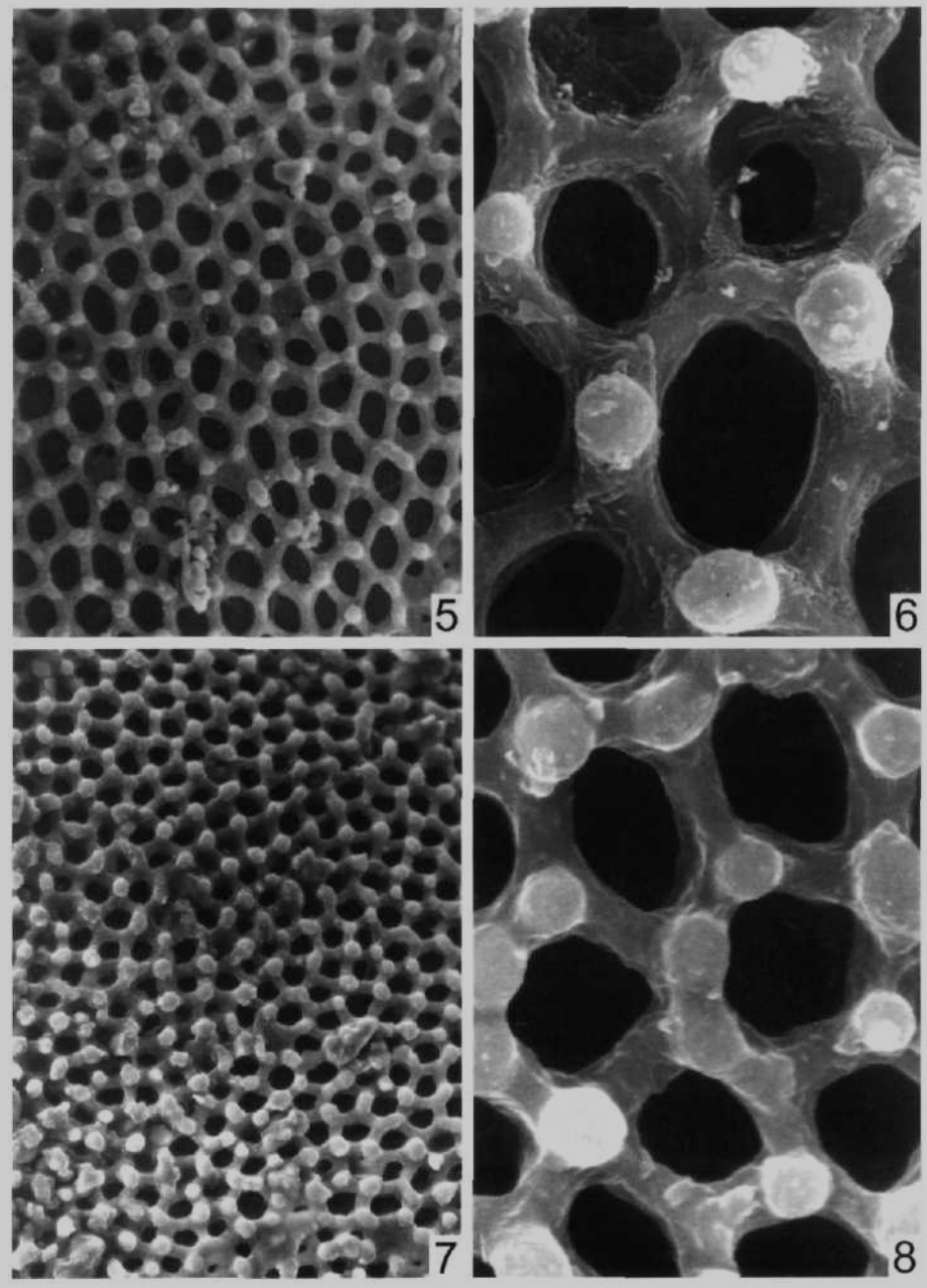
Amara (*Amara*) *makolskii* Roubal, 1923
(Figs 3, 4, 20–29)

Colour. Head yellow-brown, thoracic and abdominal terga yellow-brown to brown-gray.

[1] for details see Buchar (1982)



Figs 1–4. Scanning electron micrographs of the superficial chorion structure. 1 (2700×) , 2 (13500×): *Amara* (*A.*) *communis* (Panzer) (Slovakia or. Latorica River, Bol'), 3 (2700×), 4 (13500×): *A.* (*A.*) *makolskii* Roubal (Bohemia occ., Sóos).

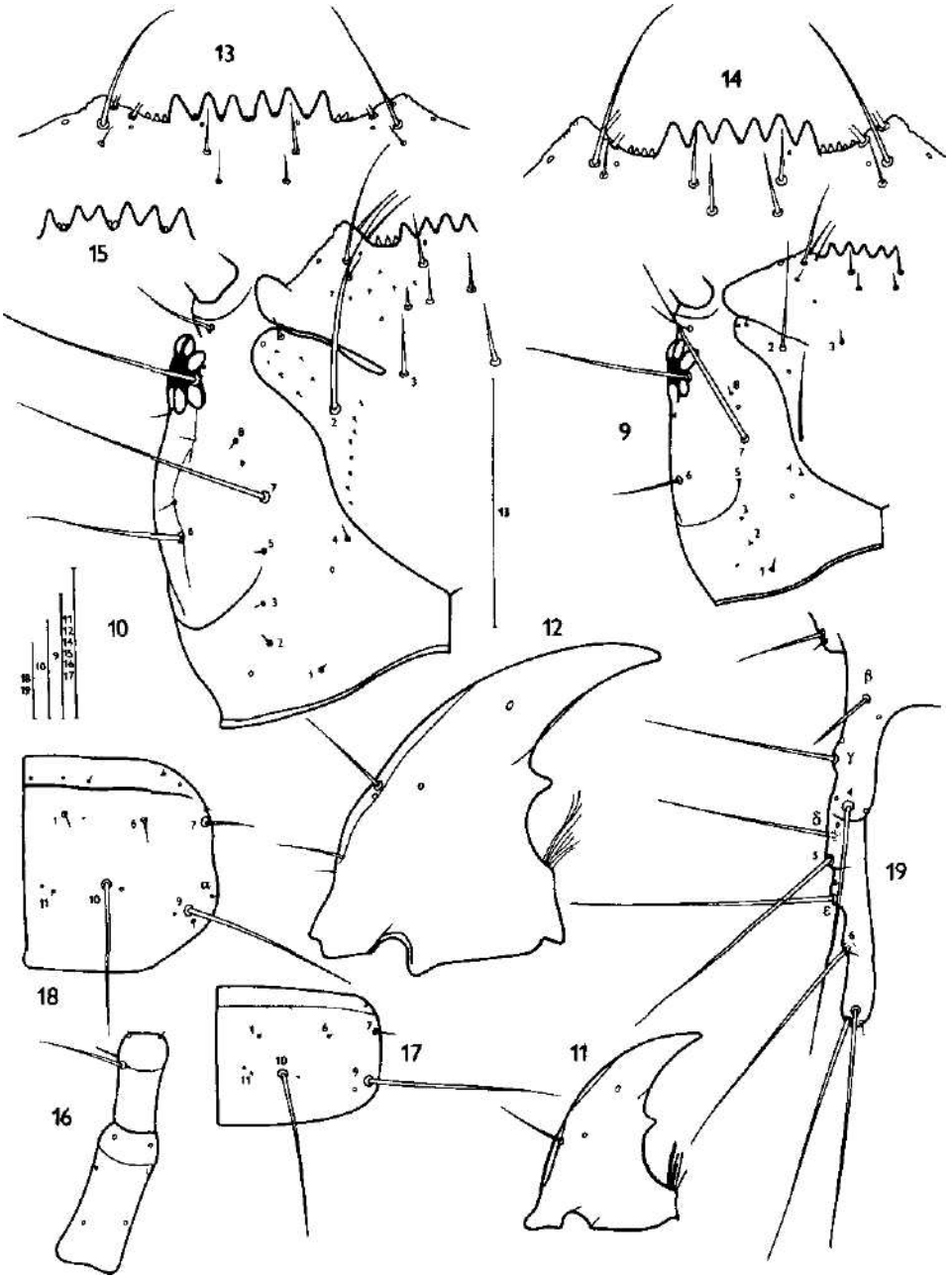


Figs 5–8. Scanning electron micrographs of the superficial chorion structure. 5 (2700×), 6 (13500×): *Amara* (*A.*) *convexior* Stephens (Bohemia centr. Praha-Háje), 7(2700×), 8 (13500×): *A.* (*A.*) *pulpani* Kult (Bohemia occ., Kraslice).

EGG. Pores of the chorion structure slightly oval with two to three marginal projections (Figs 3, 4).
LARVAL STAGE. THIRD INSTAR. Head: cephalic capsule transverse (index width/length = 1.40–1.45), sides only slightly convex; cervical grooves distinct, reaching space between PA_3 and PA_5 dorsally and almost reaching PA_{15} ventrally; coronal suture as long as about two thirds of the length of antennomere IV (0.67–0.73); nasale with six large teeth, the inner and the outer teeth slightly more spaced (Fig. 25); mandibles with one longer and 1–2 small secondary setae; antennomere I with one slight secondary seta, antennomere II with 1–2 secondary setae, labial palpomere I without secondary seta; width of head capsule in three specimens: 1.14, 1.14, 1.15 mm (Burakowski 1967: 1.13–1.30 mm). Thorax: femora with 4–8 spiniform secondary setae. Abdomen: terga I–IV with setae $TE_{1,6,7}$ distinct, setae $TE_{9,10}$ long, seta TE_{10} at least three times as long as seta TE_7, TE_α slight or absent (Fig. 28); urogomphi nearly as long as width of tergum IX, with four strong secondary setae, UR_α absent, UR_β of about two thirds to three fourth of UR_γ length (aver. 0.64, n=6).
SECOND INSTAR. Head: index width/length = 1.47; coronal suture as long as about two thirds of antennomere IV length; antennomere I without secondary seta, antennomere II with one secondary seta; width of head capsule 0.91 and 0.96 mm (Burakowski 1967: 0.85–0.95 mm). Thorax: femora with 4–5 spiniform setae. Abdomen: urogomphi slightly longer than width of tergum IX.
FIRST INSTAR. Head: index width/length = 1.40; egg burster forming a ridge composed of very small, blunt teeth, more spaced proximad, reaching over the base of FR_2, PA_4 petty (Fig. 20); coronal suture nearly half as long as length of antennomere IV (0.45–0.50), width of head capsule 0.69, 0.71, 0.72 mm (Burakowski 1967: 0.62–0.75). Abdomen: tergal setae of the posterior row ($TE_{9,10}$) at least five times as long as setae of the anterior row (TE_7) (Fig. 27); urogomphi 1.20–1.40 times as long as width of tergum IX.

Amara (Amara) convexior Stephens, 1828
(Figs 5, 6, 30–39)

COLOUR. Head, thoracic and abdominal terga yellow-brown, in first instar terga pale brown.
EGG. Pores of the chorion structure oval, large, with three to four marginal projections (Figs 5, 6).
LARVAL STAGE. THIRD INSTAR. Head: cephalic capsule transverse (index width/length = 1.40–1.50), sides slightly convex; cervical grooves distinct, reaching almost seta PA_5 dorsally and PA_{15} ventrally; coronal suture about as long as length of antennomere IV (0.90–1.0, aver 0.95, n=8); nasale with six large, nearly equally spaced teeth (sometimes greater space in middle) (Fig. 35); mandibles mostly only with one longer secondary seta; antennomere I with one slight inner secondary seta, antennomere II with regurarly 2 secondary setae, labial palpomere I without secondary seta; width of head capsule 1.34–1.50 mm (aver. 1.44, n=10). Thorax: femora with 4–8 spiniform secondary setae. Abdomen: terga I–IV with setae $TE_{6,7}$ distinct, setae $TE_{9,10}$ long, seta TE_{10} at least three times as long as seta TE_7, TE_α slight or absent (Fig. 38); urogomphi slightly longer (1.1–1.2 times) than width of tergum IX, in-curved apicad, with three strong secondary setae, UR_α and UR_β absent (Fig. 39).
SECOND INSTAR. Head: index width/length=1.40–1.45; coronal suture as long as two thirds to three fourth of length of antennomere IV; antennomere I without secondary seta, antennomere II with one secondary seta; width of head capsule 1.03–1.12 (aver. 1.08, n=6) mm. Thorax: femora with 4–5 spiniform secondary setae. Abdomen: tergal seta TE_{10} at least four times as long as seta TE_7; urogomphi 1.2–1.3 times as long as width of tergum IX.
FIRST INSTAR. Head: index width/length = 1.30–1.40; egg burster forming a ridge composed of very small, blunt teeth, more spaced proximad, reaching the base of FR_2, PA_4 petty (Fig. 30); coronal suture as long as two thirds of the length of antennomere IV (0.66–0.70), width of head capsule



Figs 9-19. *Amora (A.) communis* (Panzer). 9, 10: ccphalic capsulc of Li, L_3, I I , 12: mandiblc of L_u L_3, 13: nasále of L|, 14, 15: nasále of L,, 16: antennomercs I+II of L,, 17, 18: abdominal tergum IV of L_L, L_J, 19: tergum IX and urogomphus of L,. Scalcs = 0.2 mm.

0 78–0 84 (aver 0 81, n=8) mm (Arndt 1991 0 75–0 85 mm) Abdomen tergal setae of the posterior row ($TE_{9,10}$) at least six times as long as setae of the anterior row (TE_7) (Fig 37), urogomphi 1 20–1 40 times as long as width of tergum IX

Amara (*Amara*) *pulpani* Kult, 1949
(Figs 7, 8, 40–49)

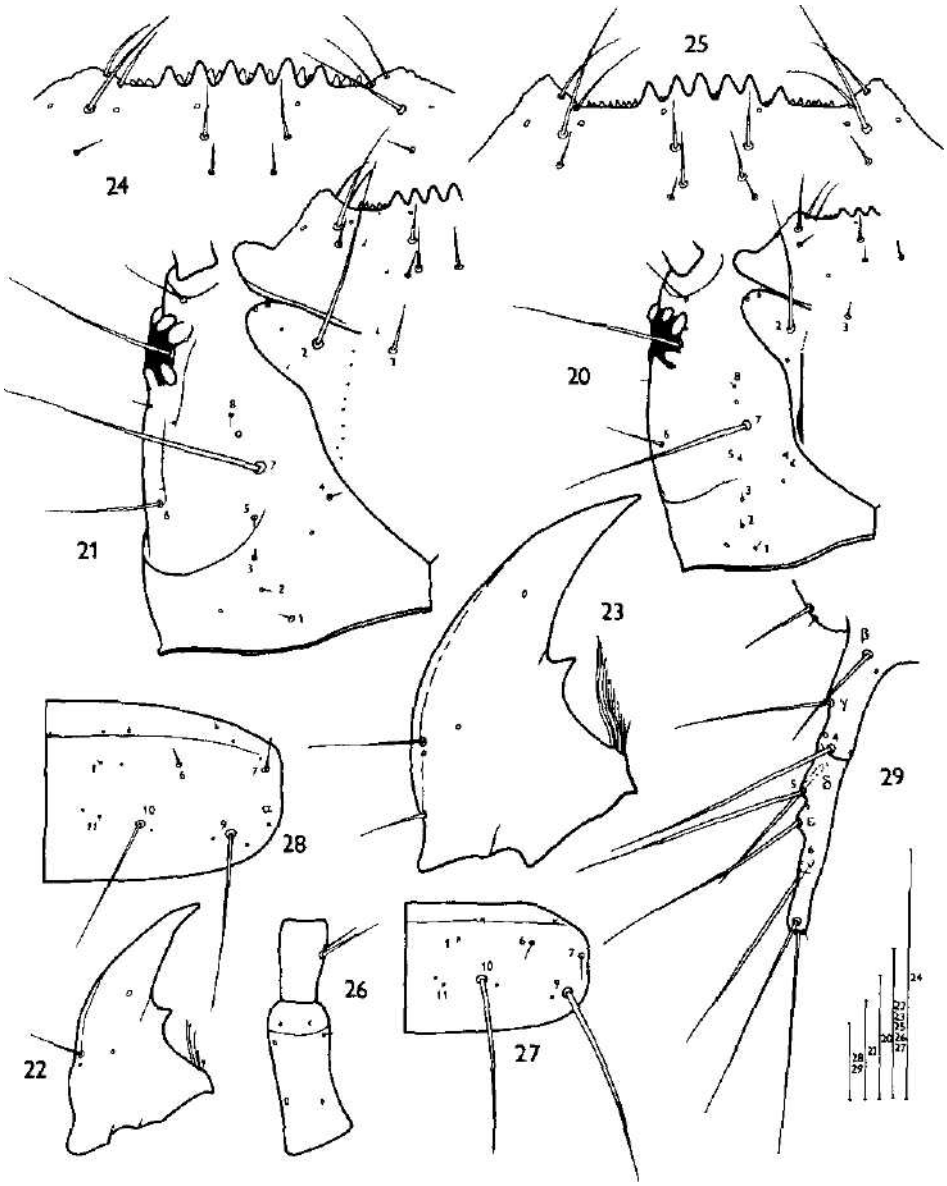
COLOUR Head yellow-brown, thoracic and abdominal terga yellow brown to brown-gray
EGG chorion structure with angular (pentagonal) pores with mostly five marginal projections (Figs 7, 8)
LARVAL STAGE Third instar Head cephalic capsule transverse (index width/length = 1 31–1 35), sides slightly convex, cervical grooves distinct, reaching space between PA_3 and PA_5 dorsally and almost reaching PA_{15} ventrally, coronal suture as long as two thirds of length of antennomere IV, nasale with six large, nearly equally spaced teeth (Fig 45), mandibles with one longer and 0–1 small secondary setae (Fig 43), antennomere I without secondary seta, antennomere II with one secondary seta (very rarely with two setae, then antennomere I with one small secondary seta), labial palpomere I without secondary seta, width of head capsule 1 17–1 36 (aver 1 27, n=17) mm Thorax femora with 4–7 spiniform secondary setae Abdomen terga I–IV with only three distinct setae $TE_{7,9,10}$, TE_{11} imperceptible (Fig 48), urogomphi nearly as long as width of tergum IX (0 86–1 04, aver 0 96), with only one secondary seta UR_6 (only six long setae present) (Fig 49)
SECOND INSTAR Head index width/length = 1 27–1 31, width of head capsule 0 99–1 06 (aver 1 03, n=11) mm Thorax femora with 4–6 spiniform secondary setae
FIRST INSTAR Head index width/length = 1 23–1 28, egg bursters forming a ridge composed of very small, blunt teeth, more spaced proximad, reaching over FR_2, PA_4 imperceptible (Fig 42), coronal suture half as long as length of antennomere IV, width of head capsule 0 76–0 82 (aver 0 78, n=7) mm Abdomen tergal setae of the posterior row ($TE_{9,10}$) at least eight times as long as setae of the anterior row (TE_7) (Fig 47), urogomphi 1 15–1 25 times as long as width of tergum IX

Key to the first instar larvae

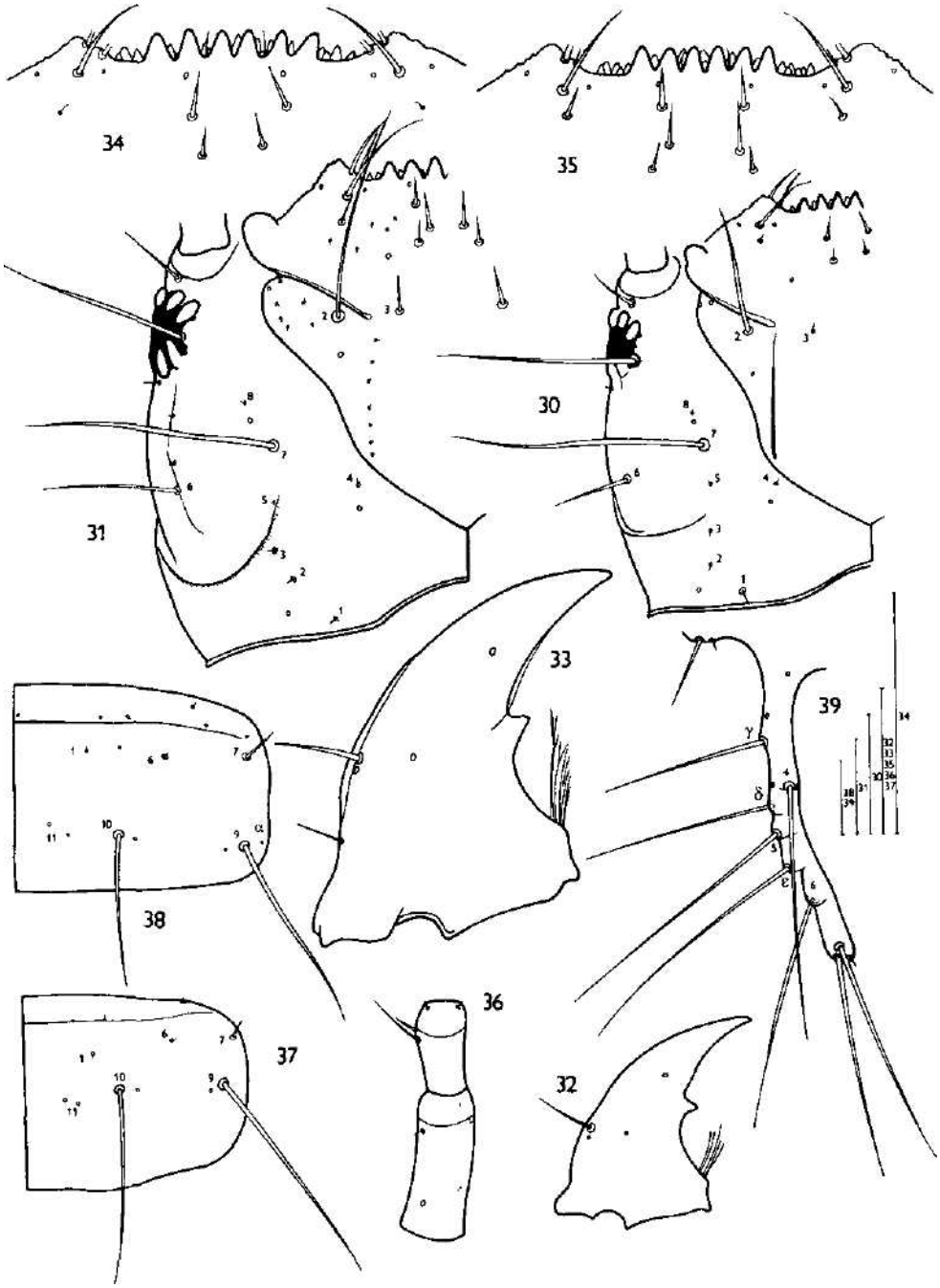
1 (2) Setae PA_4 PA_5 on parietale and TE_6 on abdominal tergum IV scarcely perceptible, seta PA_6 as long as one half to two fifths of length of PA_7 (Fig 47) *A pulpani* Kult
2 (1) Setae PA_4, PA_5 on parietale and TE_6 on abdominal tergum IV small, but distinct, seta PA_6 as long as two fifths to one fourth of PA_7 length (Figs 17, 27, 37)
3 (4) Seta PA about twice as long as seta FR_3 (Fig 30) *A convexior* Stephens
4 (3) Seta PA nearly as long as seta FR_3 (Figs 9, 20)
5 (6) Coronal suture short, at most half as long as length of antennomere IV *A makolskii* Roubal
6 (5) Coronal suture longer, at least as long as two thirds of antennomere IV length *A communis* (Panzer)

Key to the second and third instar larvae

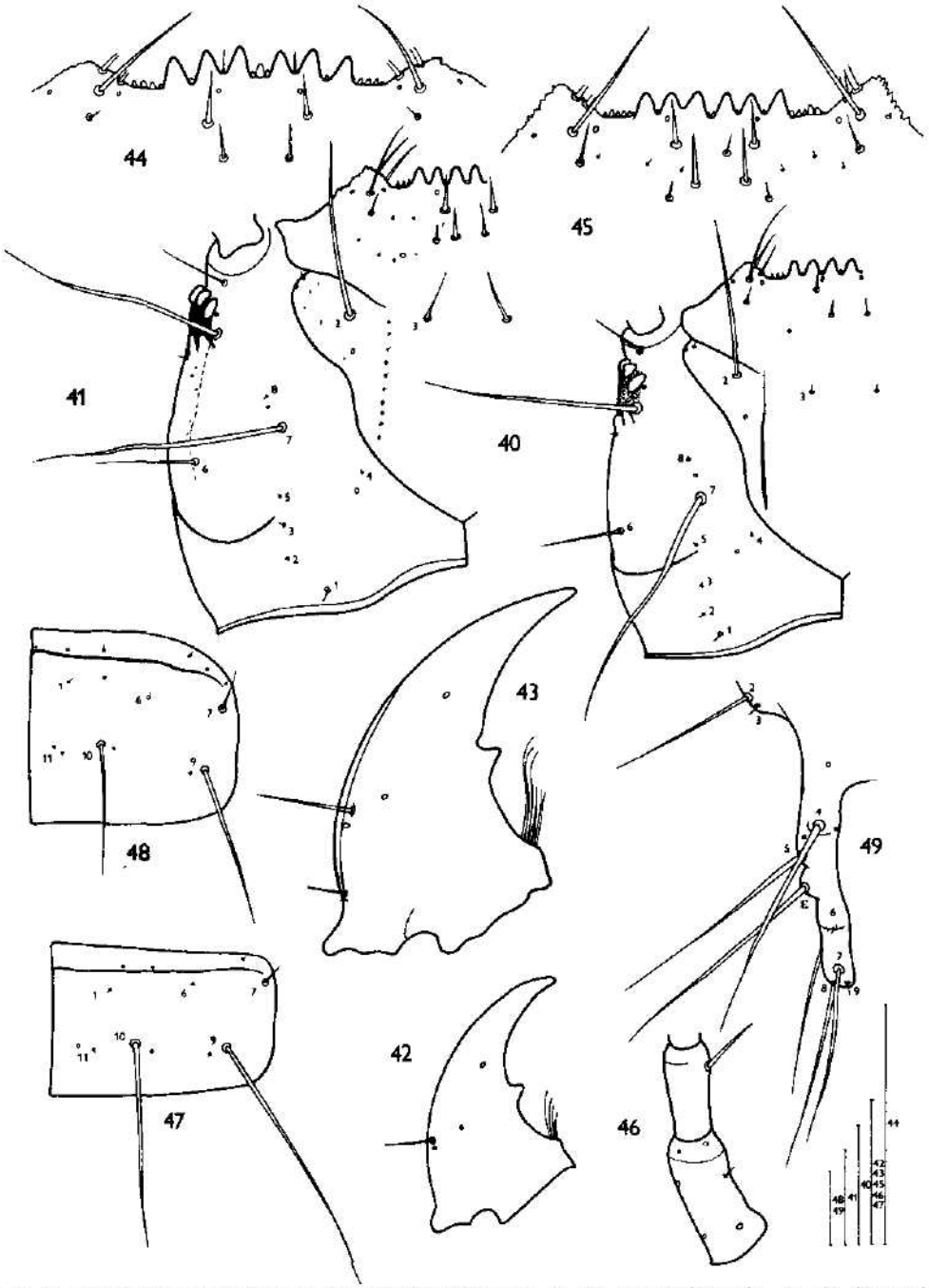
1 (2) Urogomphi with 6 strong setae (Fig 49), abdominal tergum IV with three distinct setae $TE_{7,9,10}$ setae $TE_{1,6}$ and $PA_{4,5}$ scarcely perceptible (Fig 48), antennomere II regularly with one secondary seta in both instars L_2 and L_3 *A pulpani* Kult
2 (1) Urogomphi with 8–9 strong setae (Figs 19, 29, 39), setae $TE_{1,6}$ and $PA_{4,5}$ small, but distinct antennomere II regularly with two secondary setae in L_3 and one seta in L_2
3 (4) Urogomphi with 8 strong setae (Fig 39), seta PA_5 about half as long as setae PA_2 PA_3 (Fig 31) *A convexior* Stephens
4 (3) Urogomphi with 9 strong setae (Figs 19, 29), seta PA_5 nearly as long as setae PA_2, PA_3 (Figs 10, 21)



Figs 20-29. *Amara (A.) makolsku* Roubal. 20, 21: ccphalic capsulc of L,, U 22, 23: mandiblc of L,, L_3, 24, 25: nasále of L,, L_t, 26: antcnnomcrcs l+II of L_3, 27, 28; abdominal tergum IV of L,, L,, 29: tergum IX and urogomphus of L,. Scalcs = 0.2 mm.



Figs 30-39. *Amara (A) convexior* Stcphciis. 30, 31: ccphalic capsulc of L_{1f} L_3, 32, 33: mandiblcs of L,, L-3, 34, 35: nasále of L,, L-,, 36: antennomeres I+II of L,, 37, 38: abdominaf Icrgum IV of L,, L,, 39: tergum IX and urogomphus of L_3. Scalcs = 0.2 mm.



Figs 40–49. *Amara* (*A.*) *pulpani* Kult. 40, 41: cephalic capsule of L_1, L_3, 42, 43: mandible of L_1, L_3, 44, 45: nasale of L_1, L_3, 46: antennomeres I+II of L_3, 47, 48: abdominal tergum IV of L_1, L_3, 49: tergum IX and urogomphus of L_3. Scales = 0.2 mm.

5 (6) Coronal suture longer, ratio length of coronal suture/length of antennomere IV in L_2 0.70–0.90, in L_1 0.90–1.10; urogomphi with seta UR_β regularly at most half as long as seta UR_γ (Fig. 19) . . . . . *A. communis* (Panzer)

6 (5) Coronal suture shorter, ratio length of coronal suture/length of antennomere IV in both instars L_2 and L_1 0.70–0.75; urogomphi with seta UR_β regularly at least as long as two thirds of length of seta UR_γ (Fig. 29) . . . . . *A. makolskii* Roubal

Differential diagnosis of the *Amara communis* species aggregate in the larval stage

Seta PA_4 very short, at most as long as seta PA_3. Setae in the anterior row of abdominal terga short or indistinct (especially TE_1, TE_6), setae TE_9, TE_{10} in the posterior row long, seta TE_α absent or very short, at most one tenth of length of seta TE_{10}; urogomphi with 6–9 strong setae, seta UR_α absent.

Both imaginal and larval features clearly define the *A. communis* species aggregate within the nominotypical subgenus *Amara* Bonelli.

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REFERENCES

ARNDT E. 1991 Familie Carabidae Pp. 45–141. In. KLAUSNITZER B (ed.). *Die Larven der Käfer Mitteleuropas 1 Band Adephaga* Krefeld. Goecke & Evers, 273 pp.

BOUSQUET Y 1985: Morphologie comparée de Pterostichini (Coleoptera, Carabidae) Description et tables de détermination des espèces du nord-est de l'Amerique du nord *Naturaliste Can (Rev Écol Syst)* **112** 191–251

BOUSQUET Y & GOULET H 1984 Notation of primary setae and pores on larvae of Carabidae (Coleoptera Adephaga) *Can J Zool* **62** 573–588

BUCHAR J. 1982 Publication of faunistic data from Czechoslovakia. *Věst. Čs. Společ. Zool.* **46**. 317–318.

BURAKOWSKI B 1957. Amara (Amara) pseudocommunis sp n from Central Europe (Coleoptera, Carabidae) *Annal Zool* **16**: 343–348.

BURAKOWSKI B. 1967: Biology, ecology and distribution of Amara pseudocommunis Burak (Coleoptera, Carabidae). *Annal Zool* **24**. 485–526

GERSDORF E & KUNTZE K 1957 Bestimmungstabelle der Amara-Arten (Col. Car.) Deutschlands. *Entomol Blatter*. **53** 3–21

HŮRKA K 1996: *Carabidae of the Czech and Slovak Republics.* Zlín Kabourek, 565 pp (in English and Czech)

HŮRKA K 1998 Larval taxonomy, development and diet of Amara (Amara) famelica, A (A.) littorea and A (A.) proxima (Coleoptera, Carabidae Amarina) *Acta Soc. Zool Bohem* **62**. 105–113.

KULT K 1949. Amara Pulpáni sp n and new subspecies of Pterostichus from Czechoslovakia *Folia Entomol* **12** 77–88.

LUFF M. L 1981: Diagnostic characters of the eggs of some Carabidae (Coleoptera) *Ent Scand Suppl* **15** 317–327

LUFF M L 1993: The Carabidae (Coleoptera) larvae of Fennoscandia and Denmark *Fauna Entomol Scandinavica* **27** 1–176

ROUBAL J 1923 Amara Makólskii sp. n. *Entomol Blatter* **19** 139–140

RŮŽIČKOVA A 1990 *Vývojová stadia druhů skupiny Amara communis (Amara (Amara), Carabidae, Coleoptera)* [*Developmental stages of the Amara communis species aggregate (Amara (Amara), Carabidae, Coleoptera)*] Unpubl diploma thesis Praha. Charles University, 48 pp.+ 44 figs + 28 photos.

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New synonymies in the scorpion families Buthidae, Chactidae, and Ischnuridae

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Abstract. Revision of types deposited in the Museo Zoologico de "La Specola", Firenze, Italy, shows that *Tityus piceus* Caporiacco, 1947 is a junior synonym of *Tityus cambridgei* Pocock, 1897, *Iomachus borana* Caporiacco, 1939 is a junior synonym of *Iomachus politus* Pocock, 1896, and *Broteochactas magnus* Caporiacco, 1947 (lectotype) is a junior synonym of *Broteas granimanus* Pocock, 1898. One syntype of *Broteochactas magnus* is *Broteochactas delicatus* (Karsch, 1879) Lectotype and paralectotypes are designated for *Tityus piceus*, *Broteochactas magnus*, and *Iomachus borana*

Taxonomy, new synonymy, Scorpiones, Buthidae, Chactidae, Ischnuridae

INTRODUCTION

In the course of identification and revision of scorpions deposited at the Museo Zoologico de "La Specola", Firenze, Italy (MZUF), I found that three species (belonging to three families) hitherto regarded as valid are junior synonyms. Since no work on the pertinent genera is in progress, I decided to propose the new synonymies and designation of lectotypes in this taxonomic note.

The designation of lectotypes and paralectotypes included appending laser-printed labels with species name, author and year of description, notation whether the specimen is being designated lectotype or paralectotype, dsg. F. Kovařík, 1999, and the name of the species into whose synonymy is being placed, including the author and year of description. The information is repeated in lead pencil overleaf.

Buthidae Simon, 1879

Tityus cambridgei Pocock, 1897

Tityus cambridgei Pocock, 1897: 360, Kraepelin 1899. 78.
Tityus paraensis Kraepelin, 1896: 129 (syn. by Lourenço 1984: 8).
Tityus amazonicus Giltay, 1928 79 (syn. by Lourenço 1984 9).
Tityus sampaiocrulsi Mello-Leitao, 1931. 283 (syn. by Lourenço 1984. 9).
Tityus piceus Caporiacco, 1947a 20; Caporiacco 1947b. 611; Bartolozzi et al 1987 294. **Syn. n.**

TYPE MATERIAL EXAMINED. Guyana Britannica, Campo V, XI.1931, 1 female, typus of *Tityus piceus* (hereby designated the lectotype of *Tityus piceus*), leg N Beccari; Guyana Britannica, Canister Falls, XI.1931, 1 female, typus of *Tityus piceus* (hereby designated the paralectotype No. 1 of *Tityus piceus*), leg N Beccari

COMMENTS. Caporiacco (1947a: 20) described *Tityus piceus* from an unrecorded number of females. In a later paper (Caporiacco 1947b: 611) he mentioned two females. Bartolozzi et al. (1987: 294) stated that two syntypes are deposited at MZUF. I have examined both, and hereby designate them the lectotype and paralectotype No. 1. No other author mentions additional specimens of *T. piceus*.

The original description (Caporiacco 1947a: 20) is not accompanied by a figure and is very brief. It consists of only four lines that do not include any characters differentiating *T. piceus* from *T. cambridgei*. A later description with one figure (Caporiacco 1947b: 611–612) also does not contain characters that would permit distinguishing these two species. Neither my examination of both types has revealed any such characters, and I therefore conclude that *T. piceus* is a junior synonym of *T. cambridgei*, to which it corresponds in all regards.

Chactidae Pocock, 1893

Brotheas granimanus Pocock, 1898
(Fig. 1)

Broteas granimanus Pocock, 1898: 100, Kraepelin 1899: 171
Broteochactas magnus Caporiacco, 1947a: 20, Caporiacco 1947b: 608; Bartolozzi et al. 1987: 294 **Syn. n.**

TYPE MATERIAL EXAMINED: Guyana Britannica, Campo 2, Sui, Fiume Demerara, XI 1931, 1 female (hereby designated the lectotype), leg. N. Beccari; Guyana Britannica, Campo V, XI.1931, 1 immature male, typus of *Broteochactas magnus* (hereby designated the paralectotype No. 1 of *Broteochactas magnus*), leg. N. Beccari.

Broteochactas delicatus (Karsch, 1879)
(Fig. 2)

Chactas delicatus Karsch, 1879: 134
Broteochactas delicatus: Kraepelin, 1894: 177; Kraepelin 1899: 174; Pocock 1900: 68, Caporiacco 1947b: 608
Broteas delicatus: Vachon, 1974: 930
Chactas opacus Karsch, 1879: 134 (syn. by Kraepelin 1894: 177).
Broteas panamensis Thorell, 1893: 382, Bartolozzi et al. 1987: 297 (syn. by Kraepelin 1899: 176)
Broteochactas magnus (in part) Caporiacco, 1947a: 20; Caporiacco 1947b: 608, Bartolozzi et al. 1987: 294.

MATERIAL EXAMINED: Guyana Britannica, Curupucari, XI 1931, 1 male, type of *Broteochactas magnus*, leg. N. Beccari.

COMMENTS. Caporiacco (1947a: 20) described *Broteochactas magnus* from an undisclosed number of specimens. In a later paper (Caporiacco, 1947b: 611) he listed three females. Bartolozzi et al. (1987: 297) stated that three syntypes are deposited at MZUF. I examined all of them and designated the largest specimen as the lectotype. Its length (75 mm) is the only measurement given in Caporiacco's (1947a: 20) description.

The original description (Caporiacco, 1947a: 20) is not accompanied by a figure and is very brief. It consists of only three lines and does not include any characters that would permit to differentiate the lectotype of *B. magnus* from *Brotheas granimanus*. Also a later, more detailed description (Caporiacco, 1947b: 611–612) does not contain characters which unequivocally separate these two species. My examination of the syntypes revealed that they belong to two species of two genera. The lectotype (female, total length 75 mm, 9 pectinal teeth) and paralectotype No. 1 (probably an immature male, total length 60 mm, 10 and 11 pectinal teeth) belong to *Brotheas granimanus* (Fig. 1), whereas the third specimen (a male, total length 53 mm, 8 pectinal teeth) belongs to *Broteochactas delicatus* (Fig. 2).

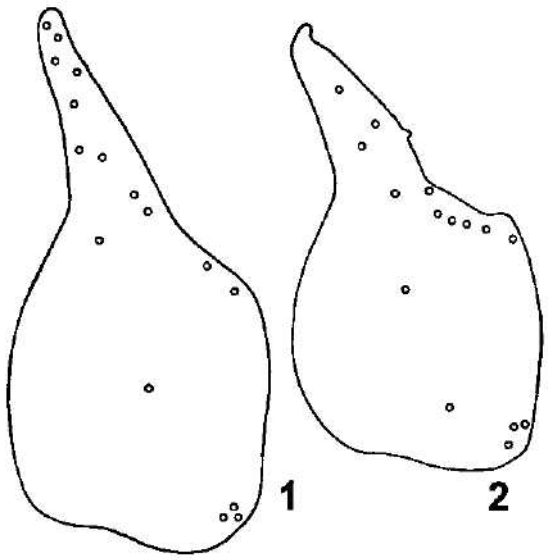
Ischnuridae Simon, 1879

Iomachus politus Pocock, 1896

Iomachus politus Pocock, 1896: 317; Kraepelin 1899: 156
Jomachus politus: Kraepelin, 1896: 138; Caporiacco 1939: 307; Caporiacco 1949: 314.
Jomachus borana Caporiacco, 1939: 307, Moriggi 1941: 96, Bartolozzi et al. 1987: 295 **Syn. n.**
Iomachus borana: Sreenivasa-Reddy, 1968: 759; Lamoral & Reynders 1975: 544

TYPE MATERIAL EXAMINED Ethiopia, Borana, Neghelli, 10 III 1937, 2 juvs, type of *Jomachus borana* (hereby designated the lectotype and paralectotype No 1 of *Jomachus borana*), leg E Zavattari

COMMENTS Caporiacco (1939 307) described *Jomachus borana* from two specimens They are juveniles of which the larger is 24 3 mm long, and Caporiacco apparently thought it to be an adult female In the same paper (Caporiacco, 1939 307) are included two truly adult specimens from the same locality (Neghelli, 29 III 1937), which are identified as *J politus* I examined both syntypes of *J borana* and designate them the lectotype and paralectotype No 1 I am certain they are juveniles of *J politus*



Figs 1–2 *Broteochactas magnus* Caporiacco Tibia of pedipalps 1 – lectotype of *Broteochactas magnus* (= *Brotheas granimanus*) 2 – syntype of *Broteochactas magnus* (= *Broteochactas delicatus*)

Acknowledgements

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REFERENCES

BARTOLOZZI L , VANNI S & MASCHERINI S W 1987 Cataloghi del Museo zoologico La specola (sezione del Museo di Storia naturale) dell'Universita' di Firenze V Arachnida Scorpiones Tipi *Atti Soc Tosc Sci Natur Mem , ser B* **94** 293–298

CAPORIACCO L 1939 Arachnida Missione Biol *Paese Borana Roma* **3** 303–385

CAPORIACCO L 1947a Diagnosi preliminari di specie nuove di Aracnidi della Guiana Britannica *Monit Zool Ital* **56**(1/6) 20–34

CAPORIACCO L 1947b Arachnida of British Guiana collected in 1931 and 1936 by Professor Beccari and Romiti *Proc Zool Soc Lond* **118** 607–612

GILTAY M L 1928 Arachnides nouveaux du Bresil *Ann Soc Entomol Belgiq* **68** 79–87

KARSCH F 1879 Skorpionologische Beitrage I and II *Mitt Munch Entomol Ver* **3** 6–22, 97–136

KRAEPELIN K 1896 Neue und wenig bekannte Skorpione *Jahrb Hamburg Wiss Anstalten* **13**(1895) 121–145
KRAEPELIN K 1899 *Das Tierreich 8 Lieferung Scorpiones und Pedipalpi* Berlin Verlag von R Friedlander und Sohn, 265 pp
LAMORAL B H & REYNDERS S 1975 A catalogue of the scorpions described from the Ethiopian Faunal Region up to December 1973 *Ann Natal Mus* **22** 489–576
LOURENÇO W R 1984 Revisao critica das espécies Tityus do Estado do Para (Scorpiones, Buthidae) *Bol Mus Paraen E Goeldi* **1** 5–18
MELLO-LEITAO C 1931 Dois novos escorpioes do Brasil *Bol Mus Nac Zool Rio de Janeiro* **7** 283–288
MORRIGGI M 1941 Gli Scorpioni dell'Africa orientale Italiana *Riv Biol Col* **4** 77–103
POCOCK R I 1896 Notes on some Ethiopian Species of Ischnurinae contained in the Collection of the British Museum *Ann Mag Natur Histor* **6(17)** 312–318
POCOCK R I 1897 Report upon the Scorpiones and Pedipalpi obtained on the Lower Amazons by Messrs E E Austen and F Pickard Cambridge during the trip of Mr Siemens's Steamship Faraday *Ann Mag Natur Histor* **6(19)** 357–368
POCOCK R I 1898 The Species of Scorpions of the Genus Broteas *Ann Mag Natur Histor* **7(2)** 98–103
POCOCK R I 1900 *The fauna of British India, including Ceylon and Burma Arachnida* London Taylor and Francis, 279 pp
SREENIVASA-REDDY R P 1968 Contribution á la connaissance des Scorpions de l'Inde 5 Le genre Iomachus Pocock, 1893 (Scorpionidae, Ischnurinae) *Bull Mus Nat Hist Nat Paris* **40** 759–767
THORELL T 1893 Scorpiones exotici R Musei Historiae Naturalis Florentini *Bull Soc Entomol Ital* **25** 356–387
VACHON M 1974 Etude des caractéres utilisés pour classer les familles et les genres de Scorpions *Bull Mus Natur Histor Natl Paris* **140**(1973) 857–958

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Palnia cambeforti sp. n. from Yunnan (Coleoptera: Scarabaeidae: Aulonocneminae)

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Abstract *Palnia cambeforti* sp. n. is described from Yunnan (China) and its diagnostic characters are illustrated. The new species is distinguished from both previously known species by having meso- and metatibia armed with short longitudinal row of very short, remarkably thickened setae distally while meso- and metatibia of *P. loebli* Stebnicka, 1985 and *P. stebnickae* Cambefort, 1989 are unarmed distally.

Taxonomy, new species, Coleoptera, Scarabaeidae, Aulonocneminae, Palaearctic region, Oriental region

INTRODUCTION

The 52 presently known species of Aulonocneminae, a small enigmatic subfamily of Scarabaeidae, are recently assigned four genera. Two of them, *Ankaratrotrox* Paulian, 1954 (six species) and *Manjarivolo* Paulian, 1974 (three species) are endemic for Madagascar and the adjacent islands. Distribution range of the most numerous genus, *Aulonocnemis* Klug, 1838 (42 species), is restricted almost exclusively to the Madagascar zoogeographical subregion. Only two species inhabit the Subsaharan Africa (Cambefort 1987). *Aulonocnemis sumatrae* Fairmaire, 1896, based on one monstrous specimen from Sumatra, has been newly transferred to the Euparini genus *Ataenius* Harold, 1867 (Cambefort 1987). Only one genus, *Palnia* Stebnicka, 1985, is at present known from the Oriental region, and comprises two species, *P. loebli* Stebnicka, 1985 and *P. stebnickae* Cambefort, 1989. Third species, *Palnia cambeforti* sp. n., discovered from the transition zone between the Palaearctic and Oriental regions, is described in the present paper.

MATERIAL AND METHODS

Specimens chosen for scanning electron micrographs were cleaned by ultrasound.

Specimens of the newly described species are provided with one red printed label: Palnia cambeforti sp. n. HOLOTYPUS, ALLOTYPUS or PARATYPUS with No. xx [symbol for male or female] David Král det. 1999. Exact label data are cited for the type material. Author's remarks and complementations are found in square brackets.

SYSTEMATIC PART

Palnia cambeforti sp. n.

(Figs 1–10)

TYPE MATERIAL. Holotype (male), allotype (female) and paratypes Nos 1–6 (not sexed), labelled: China C-YUNNAN 60 km SE Kunming SHILIN (Stone Forest) lgt. D. Král 3–4/7'[19]90 [printed] Holotype, allotype and paratypes Nos 1–4 in David Král collection, Praha, paratype No. 5 in the collection of Museum d'histoire naturelle, Genève, paratype No. 6 in the collection of Muséum national d'Histoire naturelle, Paris.

DESCRIPTION. Body length 2.4–2.6 mm (HT – 2.5 mm, AT – 2.6 mm). Oblong, convex, castaneous, antennae pale, remarkably shiny (Fig. 1).

Head (Fig. 2). Clypeus semicircular about twice as wide as long, anterior margin not upturned, frontoclypeal suture indicated only laterally by short darkened line, gena rounded, not separated from clypeus, slightly exceeding eye laterally. Surface covered with coarse, dense, regularly distributed punctures separated by approximately their diameter; every puncture bearing very short, erect seta. Labrum (Fig. 2) with transversal row of setiferous punctures.

Pronotum (Figs 1, 3) subquadrate, widest approximately at middle, strongly convex especially in anterior half; except for anterior margin all around bordered. Anterior angles subacute, only slightly projecting over anterior margin, sides in anterior half almost straight and almost parallel then rounded to broadly rounded, and slightly emarginate posterior angles; emarginations and basal margin remarkably crenate and densely setaceous. Surface anteromedially covered with fine, sparsely and regularly distributed punctures, laterally and posteriorly punctation becoming gradually remarkably coarser and denser, punctures separated by approximately their diameter; every puncture bearing short erect seta.

Scutellum (Fig. 4) triangular, apically acute, impunctate.

Elytra (Figs 1, 4) almost parallel-sided, with distinct humeral denticle, slightly bordered basal margin, and 8 striae. Striae hollowed basally and apically, narrower than intervals and impunctate, striae 1–5 discally absent, stria 6 discally very finely impressed, stria 7–8 distinctly impressed along entire length, intervals basally and apically moderately convex, discally flat, with two contiguous rows of coarse punctures bearing short, erect seta.

Macropterous.

Metasternal plate flat, midline absent, remarkably coarsely punctate, each puncture bearing short, erect seta (Fig. 8). Profemora coarsely punctate, meso- and metafemora posteriorly bordered, finely, sparsely punctate (Fig. 8). Protibia laterally tridentate (Fig. 5), meso- and metatibia distally with longitudinal row of approximately 7 very short and thickened setae (Figs 6, 7).

Abdominal sternites remarkably coarsely punctate, each puncture bearing short, erect seta (Fig. 8).

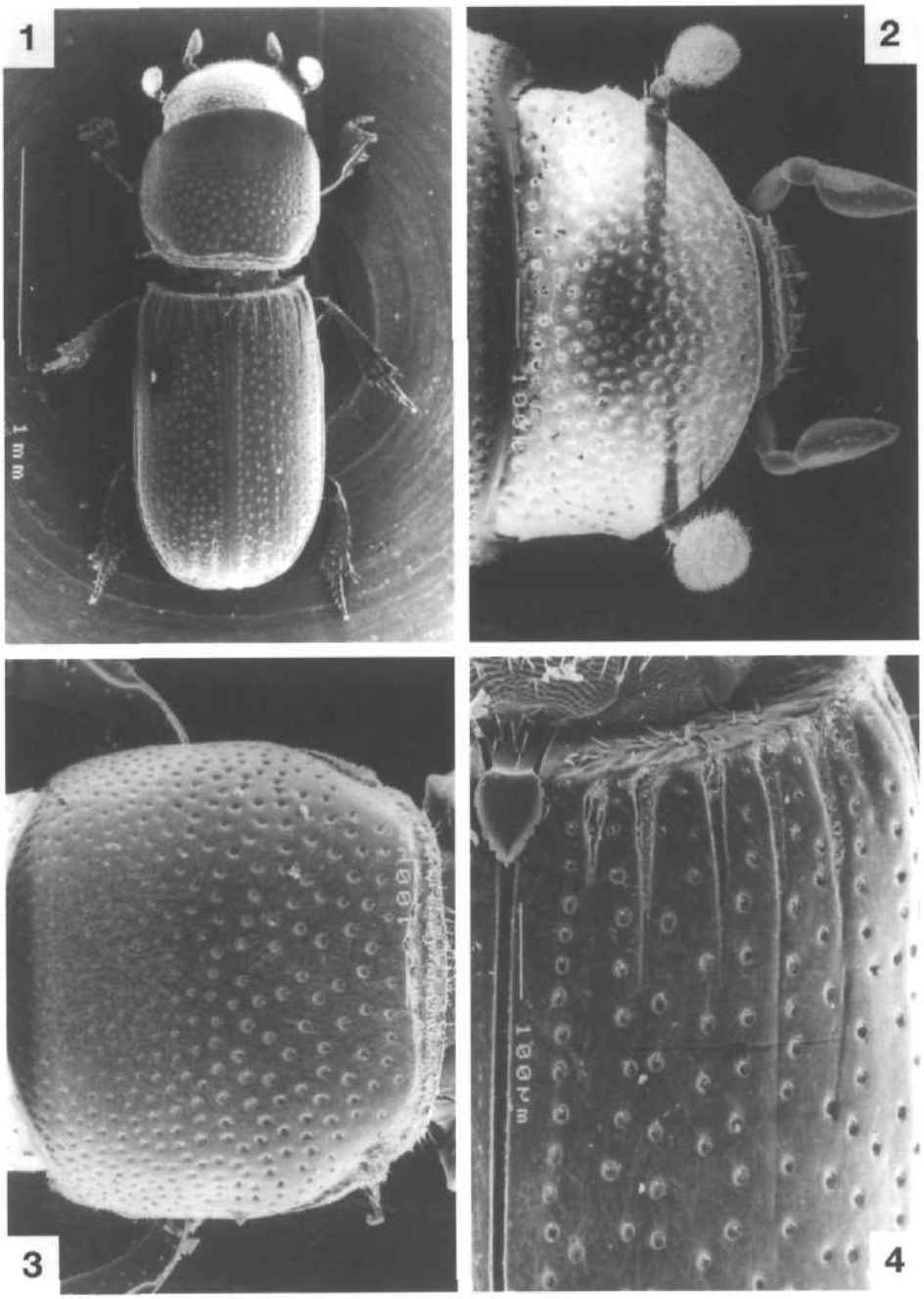
For parameres see Fig 9, 10.

DIFFERENTIAL DIAGNOSIS. *Palnia cambeforti* sp. n. differs from the both previously known species remarkably by having meso- and metatibia distally armed with short longitudinal row of very short, distinctly thickened setae (Figs 6, 7) while meso- and metatibia of *P. loebli* and *P. stebnickae* are unarmed distally. In addition, *P. loebli* and *P. stebnickae* are distinctly larger (3.0 mm), and in *P. loebli* abdominal sternites are only finely punctate (see Stebnicka 1985, fig 6). Parameres of both species are differently shaped as those of *P. cambeforti* sp. n. (see Figs 9, 10 and Cambefort 1989, figs 3, 4 and Stebnicka 1985, fig. 15).

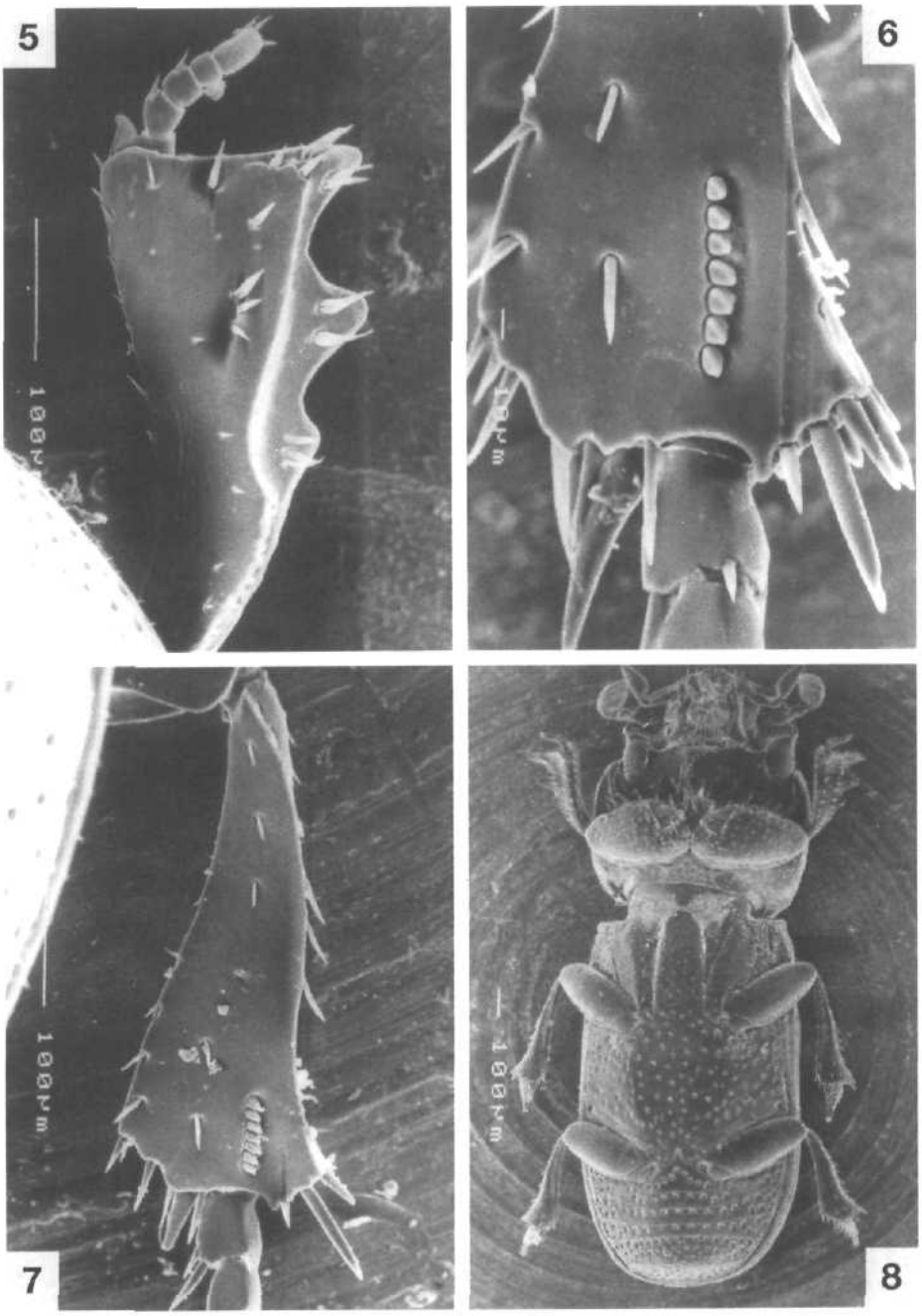
COLLECTION CIRCUMSTANCES. All specimens of the new species were collected at light.

DISTRIBUTION. China (Yunnan).

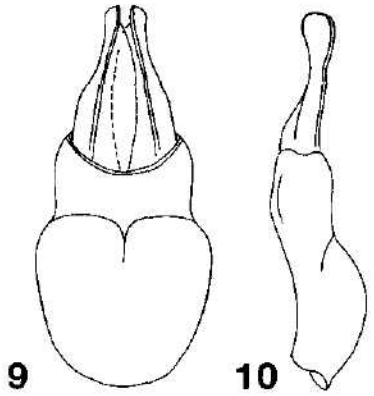
NAME DERIVATION. Patronymic, dedicated to my colleague Yves Cambefort (Muséum national d'Histoire naturelle, Paris), the renowed specialist on world fauna of Aulonocneminae.



Figs 1–4. *Palnia cambeforti* sp. n., dorsal aspect of paratype No 1. 1 – habitus, 2 – head, 3 – pronotum, 4 – basal part of right elytron.



Figs 5–8. *Palnia cambeforti* sp. n. 5 – right protibia, 6 – right mesotibia, 7 – right metatibia, 8 – habitus (5–7 dorsal aspect of paratype No 1, 8 – ventral aspect of paratype No 2).



Figs 9, 10 *Palnia cambefort* sp n , aedagus of holotype (9 – dorsal aspect, 10 – left lateral aspect)

Acknowledgements

Thanks are due to the following persons Ivan Lobl (Museum d'histoire naturelle, Genève) made the *Palnia* material in his care available to study, Aleš Smetana (Food and Agriculture Canada, Ottawa) read an earlier draft of the paper and made helpful comments, Tomaš Scholz, and the staff of the Laboratory of Electron Microscopy (Institute of Parasitology, Ceske Budějovice) helped with preparing the scanning electron micrographs The study was supported in part by grants from the Charles University Grant Agency (GAUK 262/1999) and the Ministry of Education (MŠMT ČR J13/98113100004)

REFERENCES

CAMBEFORT Y 1987 *Insectes Coleoptères Aulonocnemidae Fauna de Madagascar 69* Paris Museum national d'Histoire naturelle, 86 pp

CAMBEFORT Y 1989 Une deuxieme espece du genre oriental Palnia Stebnicka (Col Scarabaeoidea Aulonocnemidae) *Bull Soc Entomol Fr* **93** 270–272

STEBNICKA Z 1985 A new genus and species of Aulonocneminae from India with notes on comparative morphology (Coleoptera Scarabaeidae) *Rev Suisse Zool* **92** 649–658

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Three new *Tanyproctus* species from Yunnan (Coleoptera: Scarabaeidae: Melolonthinae)

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Abstract The following new species of the pachydemine genus *Tanyproctus* Faldermann, 1835 from the Chinese province Yunnan are described. *T. diurnus* sp. n., *T. jizu* sp. n. and *T. nocturnus* sp. n. Their diagnostic characters (protarsomeres and parameres) are illustrated. Bionomical notes on e.g., time of activity (*T. diurnus* sp. n. seems to be species with strictly diurnal activity while *T. nocturnus* sp. n. is typical nocturnal species) and on mating behaviour are given.

Taxonomy, description, bionomy, Scarabaeidae, Melolonthinae, Pachydemini, *Tanyproctus*, Palaearctic region

INTRODUCTION

The pachydemine genus *Tanyproctus* Faldermann, 1835 is known to have a typically disjunctive distribution. The majority of species (about 90) inhabit the Eastern Mediterranean subregion reaching Caucasus, Turkmenistan and Uzbekistan (Baraud 1985, 1987, 1992, Medvedev 1952, Nikolaev 1987) and eastern Iran and Afghanistan (Lacroix 1997, Petrovitz 1955, 1968). One species is endemic to Socotra (Lacroix 1994). The reminder of the hitherto known species are restricted to the transition zone between the Palaearctic and Oriental regions (Chang 1987, Chang & Luo 1981, Fairmaire 1886, Lacroix 1996, 1997 and Zhang & Yang 1997).

Until now, only the following five species were known from China: *T. davidis* Fairmaire, 1886 (Yunnan prov.), *T. parvus* Chang et Luo, 1981 (described from Donghai), *T. xizangensis* Chang 1987 (Xizang [= Tibet]), and *T. dechambrei* Lacroix, 1996 and *T. sanxiaensis* Zhang et Li, 1997 (both from Sichuan prov.). One species, *T. feai* Lacroix, 1997, is described from Myanmar [= Burma]. In the present paper three new species from Yunnan are described.

MATERIAL AND METHODS

At least five specimens, if available of each species under study, were dissected for examination of parameres.

The following codes (after Arnett et al. 1993) identify the collections housing the material examined.
DKCP – Czech Republic, Praha, David Král collection;
GSCR – Italy, Roma, Guido Sabatinelli collection,
MHNG – Switzerland, Genève, Museum d'histoire naturelle,
MNCP – Czech Republic, Praha, Milan Nikodým collection;
MNHN – France, Paris, Museum national d'Histoire naturelle,
NMPC – Czech Republic, Praha, Národní muzeum;
PPCB – Czech Republic, Brno, Petr Pacholátko collection,
SMTD – Germany, Dresden, Staatliches Museum für Tierkunde.

Specimens of the newly described species are provided with one red printed label [Name of a taxon] sp n HOLOTYPUS, ALLOTYPUS or PARATYPUS with No, [symbol for male or female], David Král det 1999 Exact label data are cited for the material, all labels are printed. Author's remarks and complementations are found in square brackets

SYSTEMATIC PART

Tanyproctus diurnus sp. n.

(Figs 2, 7, 8)

TYPE MATERIAL. Holotype (male), allotype (female), paratypes Nos 1–57 (males) and Nos 58–59 (females), labeled YUNNAN 2000–3000m 27 20N 100 11E HABASHAN mts NE slope 10–13/7 92 David Král leg.; paratypes Nos 60–115 (males) YUNNAN 2000–3000m 27 20N 100 11E HABASHAN mts NE slope 10–13/7 92, paratypes Nos 116–141 (males) and Nos 142–146 (females) YUNNAN cca 2000m 27 15N 100 09E HUTIAO gorge Jinsha r 18 22 7 92 David Král leg ; paratypes Nos 147–158 (males) YUNNAN cca 2000m 27 15N 100 09E HUTIAO gorge Jinsha r 18 –22 7 92; paratype No 159 (male) China N-YUNNAN 27°18'N 100°13'E Jinsha r vall 1900 m, DAJU, HUTIAO gorge lgt D Kral, 15–17/7'90. Holotype, allotype and paratypes Nos 1–24, 35–47, 58–59, 116–145 and 159 in DKCP, paratypes Nos 25–26 in GSCR; paratypes Nos 27–28 in MHNG, paratypes Nos 48–57 in MNCP, paratypes Nos 29–30 in MNHN, paratypes Nos 31–32 in NMPC, paratypes Nos 60–115 and 146–158 in *PPCB*, paratypes Nos 33–34 in SMTD

DESCRIPTION. Body length 13.0–14.5 mm (holotype 13.5 mm, allotype 14.0 mm). Dorsal surface moderately shiny, elytron moderately shiny to alutaceous; body except for chesnut brown elytron dark brown to blackish, in some specimens (e.g., paratypes Nos 35–47) also elytron blackish. Setation pale.

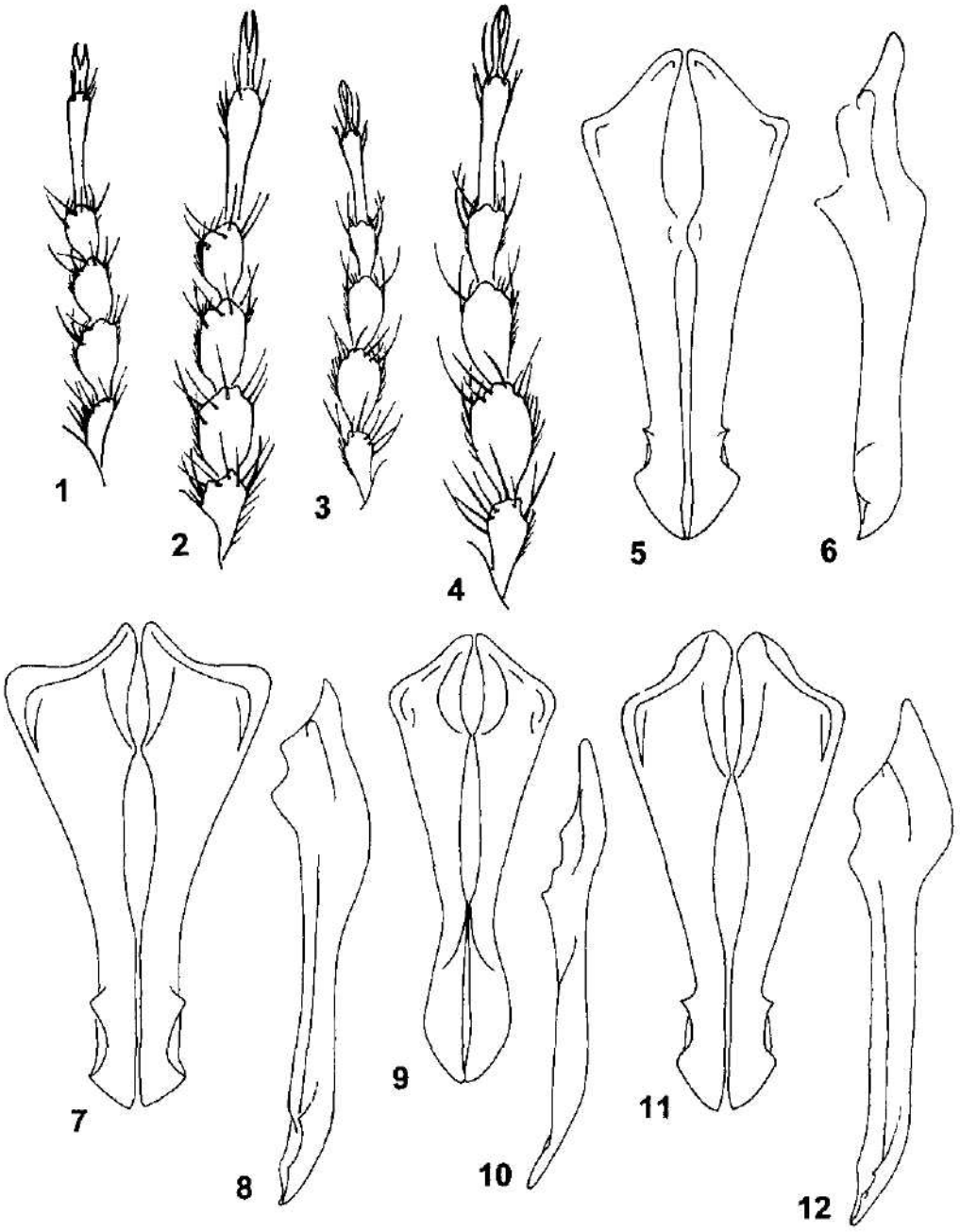
Male. Body elongate, almost parallel.

Head. Labrum small, bilobed; lobes rounded densely punctate. Outline of clypeus broadly trapezoidal with distinctly upturned margin, anteriorly slightly but distinctly emarginate, anterior angles rounded, sides weakly arcuate, anteriorly of genae slightly sinuate. Gena short, laterally rounded. Frontoclypeal suture straight or feebly arcuate, distinctly impressed. Eye relatively small, externally in dorsal aspect almost not exceeding gena; distance between both eyes in ventral aspect extended remarkably diameter of eye. Surface of clypeus and vertex bare; punctation of clypeus coarse, almost regular, punctures separated by less than their diameter or confluent; punctation of vertex approximately same as on clypeus. Antenna decamerous, antennomere 2 short, approximately as long as wide, antennomeres 3–5 elongate; club pentamerous, straight or only very slightly curved externally, shorter than antennal shaft (antennomeres 1–5 combined); antennomeres 1–5 with sparse long setae, club sparsely shortly setaceous. Terminal maxillary palpomere elongate, apically rounded, absent from depression, approximately of same length as palpomeres 2 and 3 combined.

Pronotum moderately convex, transversal, except for broad basal interruption around bordered; anterior bead narrow and flat, irregularly punctate; lateral margin remarkably crenate, with row of long setae, basal margin with row of densely distributed punctures bearing at least in posterior angles recumbent setae. Anterior angles prominent, projecting over anterior margin, acute with rounded apex, sides in approximately anterior two thirds almost straight, divergent posteriad to rounded posterior angles, posterior margin broadly bisinuate. Surface bare, microsculptured and finely, densely, almost regularly punctate, punctures separated by 2–4 their diameters.

Scutellum approximately as wide as long, triangulate, apex rounded to slightly angulate; basally with several punctures.

Elytron convex, slightly broadened posteriad, sutural angle rounded; striae except for sutural stria missing or only very feebly indicated; distinctly microsculptured and discally feebly transversally wrinkled, punctation coarse, dense, almost regular, punctures separated by 1–2 their diame-



Figs 1–12. Right male protarsomere (1–4); parameres, dorsal aspect (5, 7, 9, 11); right paramere, lateral aspect (6, 8, 10, 12) *Tanyproctus davidis* Fairmaire, Yunnan, syntypus from MNHN (1, 5, 6); *T. diurnus* sp n., HT (2, 7, 8); *T. jizu* sp n , HT, (3, 9, 10), *T. nocturnus* sp. n., HT (4, 11, 12).

Tab 1 Characters separating *Tanyproctus* species known from Yunnan from each other

character	*T davidis*	*T diurnus* sp n	*T jizu* sp n	*T nocturnus* sp n
body length	13 5–15 0 mm	13 0–14 5 mm	12 0–13 5 mm	13 5–18 5 mm
colour of dorsal surface	unicolorous reddish brown	as a rule bicolorous	bicolorous	as a rule unicolorous
microsculpture of dorsal surface	absent	except for head microsculptured	absent	elytron, propygidium and pygidium finely microsculptured
lustre of dorsal surface	remarkable	almost alutaceous	remarkable	moderate
eye size in dorsal aspect in male	relatively small, externally almost not exceeding gena	relatively small, externally almost not exceeding gena	relatively large, externally exceeding distinctly gena	relatively large, externally exceeding distinctly gena
distance between both eyes in ventral aspect in male	extended remarkably diameter of eye	extended remarkably diameter of eye	approximately same as diameter of eye	approximately same as diameter of eye
punctation of clypeus	coarse, irregular, punctures separated by less than their diameter or confluent	coarse, almost regular, punctures separated by less than their diameter or confluent	coarse, almost regular, punctures separated by their diameter	coarse, almost regular, punctures separated by less than their diameter or confluent
punctation of vertex	finer and regularly distributed as on clypeus, punctures separated by less than their diameter	approximately same as on clypeus	finer and denser as on clypeus, punctures separated by less than their diameter	approximately same as on clypeus
shape of antennal club in male	almost straight	almost straight	distinctly curved externally	almost straight
length of antennal club in male	shorter than antennal shaft	shorter than antennal shaft	approximately as long as antennal shaft	shorter than antennal shaft
shape of protarsomeres in male	strongly widened (Fig 1)	strongly widened (Fig 2)	relatively less widened (Fig 3)	relatively less widened (Fig 4)
width : length ratio of protarsomere 2 in male	1 : 1 6	1 : 1 5	1 : 1 8	1 : 2
shape of pronotum in male	anterior half of sides almost straight	anterior two thirds of sides almost straight	anterior half of sides almost straight	anterior two thirds of sides almost straight
punctation of pronotum	coarse, irregular, punctures separated by 1–4 their diameters	fine, regular, punctures separated by 2–4 their diameters	fine, irregular, punctures separated by 2–6 their diameters	fine, regular, punctures separated by by 2–4 their diameters
punctation of elytron	coarse, punctures separated by 1–2 their diameters	coarse, punctures separated by 1–2 their diameters	coarse, punctures separated by 1–2 their diameters	fine, punctures separated by 2–3 their diameters
shape of parameres	Figs 5, 6	Figs 7, 8	Figs 9, 10	Figs 11, 12
activity	probably diurnal species *)	diurnal species	probably nocturnal species *)	nocturnal species

*) see Discussion

ters, each puncture bearing very short, erect seta, sutural interval very slightly convex; sutural stria with row of irregularly distributed punctures; lateral margin distinctly bordered, with row of long erect setae.

Macropterous.

Femora shiny, irregularly punctate, punctures bearing long setae. Protibia distinctly tridentate, terminal calcar long, inserted between medial and basal dents. Meso- and metatibia slightly expanded apically, with two setiferous transversal carinae. Terminal calcars of mesotibia equal in length, flattened, apically acute. Terminal calcars of metatibia equal in length, slightly curved, acute apically. Protarsomere 2–4 (Fig. 2) strongly widened (width : length ratio of protarsomere 2 = 1 : 1.5), mesotarsomeres 2–4 only slightly dilated; pro- and mesotarsomeres 1–4 ventrally with remarkably shortly and densely setaceous pad, metatarsomeres ventrally covered with long setae. Claws bifid. Ventral surface of thorax with dense, long and recumbent setation.

Propygidium microsculptured, coarsely, sparsely and irregularly punctate; pygidium finally microsculptured, all around bordered, coarsely and irregularly punctate. Ventrites almost bare, remarkably coarsely and irregularly punctate.

Parameres (Figs 7, 8).

Female differs from male in the following characters: body distinctly broadened posteriorly; punctation of vertex denser to confluent; antennomere 5 transversal, antennal club approximately as long as antennomeres 3–5 combined; pronotal sides more divergent posteriorly, elytron more broadened posteriorly, pronotal and elytral surface more finely microsculptured and therefore more shiny; metatibia strongly expanded apically; pro- and metatarsomeres not dilated and absent from setaceous pads.

DIFFERENTIAL DIAGNOSIS. For differential diagnosis see Table 1.

NAME DERIVATION. The specific name, a Latin adjective "diurnus" (diurnal), refers to time of activity of the new species.

COLLECTION CIRCUMSTANCES. In total 158 males and 8 females were collected. All material was found between 1900–3000 m a.s.l., preferring open, sunny habitats covered with herbal (mostly grassy) vegetation or low shrubs, exceptionally also in woody habitats (15 males from the whole number of the specimens collected). The males were observed during sunny weather to fly sporadically, from about noon, slowly and at remarkably low level (approximately 50 cm) above surface. When disturbed, they struggle to flush quickly from a range of danger. A maximum of active males were observed at about 6 p. m. when the majority of them sit on grasses and low shrubs. After 8 p. m., still before nightfall, they disappear from view (probably concealed amongst the ground vegetation). After rain, males were observed buried in shallow hollows (6 specimens). The females were found during whole the time of activity moving slowly on surface but never flying. In two cases mating was observed at a margin of dusty pathway. Copulation occured with both individuals laying on their sides for 10 and 12 minutes respectively.

DISTRIBUTION. China: Yunnan.

Tanyproctus jizu sp. n.

(Figs 3, 9, 10)

TYPE MATERIAL. Holotype and paratypes Nos 1, 2 (all males), labeled: YUNNAN 2500–2700 m 25.58N 100.21E JIZU SHAN 6–10.7.1994. Holotype and paratype No 1 in DKCP; paratype No 2 in PPCB.

DESCRIPTION. Male. Body length 12.0–13.5 mm (holotype 12.5 mm). Body elongate, almost parallel. Dorsal and ventral surface strongly shiny, dorsum not microsculptured; bicolorous, head pronotum and extremities dark brown, elytron light chesnut brown, ventral surface brown. Setation pale.

Head. Labrum small, bilobed; lobes rounded and densely punctate. Outline of clypeus broadly trapezoidal with distinctly upturned margin, anteriorly slightly but distinctly emarginate, anterior angles rounded, anteriorly of genae slightly sinuate. Gena short, laterally rounded. Frontoclypeal suture very slightly arcuate, distinctly impressed. Eye relatively large, externally in dorsal aspect exceeding gena; distance between both eyes in ventral aspect approximately same as diameter of eye. Surface of clypeus and vertex bare; punctation of clypeus coarse, almost regular, punctures separated by their diameter; punctation of vertex finer and denser as on clypeus, punctures separated by less than their diameter. Antenna decamerous, antennomere 2 short, approximately as long as wide, antennomeres 3–5 elongate; club pentamerous, distinctly curved externally, approximately as long as antennal shaft (antennomeres 1–5 combined); antennomeres 1–2 with sparse long setae, club sparsely shortly setaceous. Terminal maxillary palpomere elongate, apically rounded, absent from depression, approximately of same length as palpomeres 2 and 3 combined.

Pronotum moderately convex, transversal, except for broad basal interruption around bordered; anterior bead narrow and flat, irregularly punctate; lateral margin remarkably crenate, with row of long setae; basal margin with row of densely distributed punctures bearing at least in posterior angles recumbent setae Anterior angles prominent, projecting over anterior margin, acute with rounded apex; sides in approximately anterior half almost straight, divergent posteriad to rounded posterior angles; posterior margin broadly bisinuate. Surface bare, finely, sparsely and irregularly punctate, punctures separated by 2–6 their diameters.

Scutellum approximately as wide as long, triangulate, apex rounded; impunctate.

Elytron convex, slightly broadened posteriad, sutural angle rounded; striae except for sutural stria missing, punctation coarse, dense and almost regular, punctures separated by 1–2 their diameters, each puncture bearing very short, erect seta; sutural interval very slightly convex, irregularly punctate; stria 1 with row of irregularly distributed punctures; lateral margin distinctly bordered, with row of long erect setae.

Macropterous.

Femora shiny, irregularly punctate, punctures bearing long setae. Protibia distinctly tridentate, terminal calcar long, inserted between medial and basal dents. Meso- and metatibia slightly expanded apically, with two setiferous transversal carinae. Terminal calcars of mesotibia equal in length, flattened, apically acute. Terminal calcars of metatibia equal in length, slightly curved, acute apically. Protarsomeres 2–4 (Fig. 3) relatively less widened (width : length ratio of protarsomere 2 = 1 : 1.8), mesotarsomeres 2–4 only slightly dilated; pro- and mesotarsomeres 1–4 ventrally with remarkable shortly and densely setaceous pad; metatarsomeres ventrally covered with long setae. Claws bifid Ventral surface of thorax with dense, long and recumbent setation.

Propygidium coarsely, sparsely and irregularly punctate; pygidium all around bordered, and coarsely, sparsely and irregularly punctate. Ventrites almost bare, remarkably coarsely and irregularly punctate.

Parameres (Figs 9, 10).

Female unknown.

DIFFERENTIAL DIAGNOSIS. For differential diagnosis see Table 1.

NAME DERIVATION. Named after the type locality – Jizu shan Mts; noun in apposition.

DISTRIBUTION. China: Yunnan.

Tanyproctus nocturnus sp. n.
(Figs 4, 11, 12)

TYPE MATERIAL Holotype (male), allotype (female) and paratypes Nos 1–8 (males) labeled. China N-YUNNAN 27°18'N 100°13'E Jinsha r vall 1900 m DAJU, HUTIAO gorge lgt D. Král, 15–17/7'90; paratypes Nos 9–44

(males) YUNNAN 2000–3000m 27 20N 100 11E HABASHAN mts NE slope 10–13/7 92 David Kral leg , paratypes Nos 45–92 (males) YUNNAN 2000–3000m 27 20N 100 11E HABASHAN mts NE slope 10–13/ 7 92, paratypes Nos 93–102 (males) YUNNAN cca 2000m 27 19N 100 13E SABE Jinsha r 13/7 92 David Kral leg , paratypes Nos 103–118 (males) YUNNAN cca 2000m 27 15N 100 09E HUTIAO gorge Jinsha r 18 – 22 7 92 David Král leg , paratypes Nos 119–120 (males) CHINA, Yunnan prov DAJU ~ 50km N Lijiang 27,21N 100,19E 21 –26 6 1993 lgt S Becvar[Bečváf] Holotype, allotype and paratypes Nos 1–33 and 93–118 in DKCP, paratypes Nos 119–120 in GSCR, paratypes Nos 33–34 in MHNG, paratypes Nos 41–44 in MNCP, paratypes Nos 35–36 in MNHN, paratypes Nos 37–38 in NMPC, paratypes Nos 45–92 in PPCB, paratypes Nos 39–40 in SMTD

DESCRIPTION Body length 13 5–18 5 mm (holotype 17 5, allotype 14 0 mm) Dorsal surface moderately shiny, colour chesnut brown to dark brown, head, pronotum and elytral suture in some specimens (e g , paratypes Nos 13, 27, 38) rather darker Ventral surface shiny, chesnut brown, Setation pale to greyish ventrally

Male Body elongate, almost parallel

Head Labrum small, bilobed, lobes rounded densely puncate. Outline of clypeus broadly trapezoidal with distinctly upturned margin, anteriorly distinctly emarginate, anterior angles subacute, sides slightly arcuate, anteriorly of genae slightly sinuate Gena short, laterally rounded Frontoclypeal suture straight or feebly arcuate, distinctly impressed Eye relatively large, externally in dorsal aspect distinctly exceeding gena, distance between both eyes in ventral aspect approximately same as diameter of eye Surface of clypeus and vertex bare, punctation of clypeus coarse, almost regular, punctures separated by less than their diameter or confluent, punctation of vertex approximately same as on clypeus Antenna decamerous, antennomere 2 short, approximately as long as wide, antennomeres 3–5 elongate, club pentamerous, straight or only very slightly curved externally, shorter than antennal shaft (antennomeres 1–5 combined), antennomeres 1–5 with sparse long setae, club sparsely shortly setaceous Terminal maxillary palpomere elongate, apically rounded, absent from depression, approximately of same length as palpomeres 2 and 3 combined

Pronotum moderately convex, transversal, except for broad basal interruption around bordered, anterior bead narrow and flat, distinctly punctate laterally, lateral margin remarkably crenate with row of long setae, basal margin with row of densely distributed punctures bearing at least in posterior angles recumbent setae Anterior angles prominent, projecting over anterior margin, acute with rounded apex, sides in approximately two anterior thirds straight to very slightly sinuate, divergent posteriorly to rounded posterior angles, posterior margin broadly bisinuate Surface bare, not microsculptured, finely, relatively sparsely and almost regularly punctate, punctures separated by 2–4 their diameters.

Scutellum approximately as wide as long, triangulate, apically rounded to slightly angulate, very sparsely punctate or impunctate

Elytron convex, only very slightly broadened posteriad, sutural angle rounded, striae except for sutural stria missing or only very feebly indicated, finely microsculptured, punctation fine and dense, almost regular, punctures separated by 2–3 their diameters, each puncture bearing very short erect seta, sutural interval very slightly convex, sutural stria with row of irregularly distributed punctures lateral margin distinctly bordered, with row of long erect setae

Macropterous

Femora shiny, coarsely irregularly punctate, punctures bearing long setae Protibia distinctly tridentate, terminal calcar long, inserted between medial and basal dents Meso- and metatibia slightly expanded apically, with two setiferous transversal carinae Terminal calcars of mesotibia equal in length, flattened and apically subacute Terminal calcars of metatibia equal in length, slightly curved, acute apically Protarsomeres 2–4 (Fig 4) relatively less widened (width length ratio of protarsomere 2 = 1 2) mesotarsomeres 2–4 only slightly dilated, pro- and mesotarsomeres

1–4 ventrally with remarkable shortly and densely setaceous pad, metatarsomeres ventrally covered with long setae. Claws bifid. Ventral surface of thorax with long, dense and recumbent setation.

Propygidium finely microsculptured, coarsely, sparsely and irregularly punctate; pygidium finely microsculptured, all around bordered, and coarsely, densely, irregularly punctate. Ventrites almost bare, remarkably coarsely and irregularly punctate.

Parameres (Figs 11, 12)

Female (allotype) differs from male in the following characters: body distinctly broadened posteriad; punctation on vertex denser to confluent; antennomere 5 transversal, antennal club approximately as long as antennomeres 3–5 combined; pronotal sides more divergent posteriad, elytron more broadened posteriad, pronotal and elytral surface more finely microsculptured and therefore more shiny; metatibia strongly expanded apically; pro- and metatarsomeres not dilated and absent from setaceous pads.

DIFFERENTIAL DIAGNOSIS. For differential diagnosis see Table 1.

NAME DERIVATION. The specific name, a Latin adjective "nocturnus" (nocturnal), refers to the time of activity of the new species.

COLLECTION CIRCUMSTANCES. A total of 121 males and one female were collected. All specimens were found in the same habitat as *T. diurnus* sp. n. The highest altitude they were taken from was at about 2000 m a. s. l. The beginning of activity was recorded at about 9 p. m. The males were observed moving slowly on surface or sitting on grasses and low shrubs till to about 2 a. m. They were never observed when flying. The only known female was found dead on a pathway in the early morning.

DISTRIBUTION. China: Yunnan.

DISCUSSION

Two from the three above described species, *Tanyproctus diurnus* sp. n. and *T. nocturnus* sp. n., were found in the same habitat – open, sunny places covered with relatively low herbal vegetation and sparse shrubs (meadows, pastures, forest margins etc.), on the south-eastern slopes of the Habashan Mts. These two species are probably closely related (see Table 1) however they differ strongly in the times they are active. *T. diurnus* sp. n. seems to be a species with strictly diurnal activity while *T. nocturnus* sp. n. is a typical nocturnal species. Their ranges of activity probably do not overlop. Such a situation represents an interesting example of reproductive isolation between two closely related and syntopic species.

In addition, this is also correlated with size of eye. The diurnal species, *T. diurnus* sp. n., exhibits remarkably smaller eye than in the species with nocturnal activity, *T. nocturnus* sp. n. Therefore based on eye size *T. davidis* can be considered a diurnal species while *T. jizu* sp. n. a species with nocturnal activity.

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REFERENCES

ARNETT H. R. JR., SAMUELSON G. A. & NISHIDA G. M. 1993: *The insect and spider collection of the world. Flora and Fauna Handbook No. 11, Second Edition*. Gainesville. Sandhill Crane Press, 308 pp.

BARAUD J 1985 *Coleoptères Scarabaeoidea Faune du Nord de l Afrique du Maroc au Sinai Encycl Entomol*, *46* Paris Editions Lechevalier, 651 pp
BARAUD J 1987 Coleopteres Scarabaeoidea du Nord de l Afrique addenda et corrigenda *Annls Soc Entomol Fr (N S)* **23** 351–366
BARAUD J 1992 *Coleoptères Scarabaeoidea d'Europe Faune de France 78* Lyon Fed Fr Soc Entomol & Soc Linn de Lyon, 856 pp
CHANG Y W 1987 Coleoptera Geotrupidae, Hybosoridae, Ochodaeidae, Trogidae, Aphodiidae, Scarabaeidae, Melolonthidae, Dynastidae, Euchiridae *Agricultural insects, spiders, plant diseases and weeds of Xizang* **2** 65–76 (in Chinese, Engl abstr)
CHANG Y-W & LUO Y-Z 1981 On a new species of the genus Tanyproctus Faldermann (Coleoptera Melolonthidae) *Sinozoologia* **1** 55–57 (in Chinese, Engl abstr)
FAIRMAIRE L 1886 Descriptions de Coléopteres de l'interieur de la Chine *Annls Soc Entomol Fr (6e serie)* **6** 303–356
LACROIX M 1994 Pachydeminae des regions limitrophes du Golfe d'Aden et description de Canudema socotrae n gen n sp (Coleoptera, Scarabaeoidea, Melolonthidae) *Rev Fr Entomol (N S)* **16** 153–170
LACROIX M 1996 Contribution a la connaisance des Pachydeminae asiatiques (Coleoptera, Melolonthidae) *Coleopteres* **2** 91–102
LACROIX M 1997 Contribution a la connaisance des Pachydemainae asiatiques II Une nouvelle espèce du genre Tanyproctus Faldermann (Coleoptera, Scarabaeoidea, Melolonthidae) *Bull Soc Entomol Fr* **102** 183–188
MEDVEDEV S I 1952 *Plastinchatousye (Scarabaeidae), podsem Melolonthinae, ch 2 (khrushchi) Fauna SSSR, zhestokrylye, tom 10, vyp 2 [Scarabaeidae subfamily Melolonthinae, part 2 (chaffers) Fauna of USSR Coleoptera series 10, volume 2]* Moskva, Leningrad Izd Akad Nauk SSSR, 274 pp (in Russian)
NIKOLAEV G V 1987 *Plastinchatousye zhuki (Coleoptera Scarabaeoidea) Kazakhstana i Srednei Azii [Scarabaeoidea (Coleoptera) of Kazakhstan and Middle Asia]* Alma Ata Izd Nauka KazSSR, 232 pp (in Russian)
PETROVITZ R 1955 The 3rd Danish Expedition to Central Asia Zoological Results 18 Scarabaeidae aus Afghanistan *Vidensk Medd Dansk Naturhistor Foren Kbh 117* 275–287
PETROVITZ R 1968 Neue Tanyproctus und Atanyproctus-Arten (Pachydemini, Melolonthinae, Scarabaeidae) *Entomol Arb Mus Georg Frey* **19** 237–247
ZHANG Y W & LI Y G 1997 Coleoptera Glaphyridae, Dynastidae and Melolonthidae Pp 776–779 In YANG X K (ed) *Insects of the Three Gorge Reservoir area of Yangtze river Part 1* Chongqing Chongqing Publ House, xx + 974 pp (in Chinese, Engl abstr)

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Comments on classifications of insect ontogenies, and occurrence of proneometabolous wing development in termite genus *Prorhinotermes* (Hexapoda: Isoptera)

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Abstract. The recent classification of kinds of insect metamorphoses is reviewed, commented upon, and emended The neometabolic modes of the Thysanoptera Tubulifera is termed diametaboly (new term), and it is argued for re-instatement of the term homometaboly for the development of the Aphidomorpha Adelgoidea The occurrence of neometaboly in all the higher taxa of Thysanoptera and Sternorrhyncha (except Psyllomorpha) is ascribed to an underlying synapomorphy A special mode of development of forewing pads (separation of the latter by a sulcus from mesonotum) is identified in the Psyllomorpha, Coleorrhyncha and the most basal Heteroptera (Enicocephalomorpha Enicocephalidae), and is termed anaptery (new term) The peculiarities of developmental pathway, wing development, and distribution, in the genus *Prorhinotermes* Silvestri, 1909 (Isoptera Rhinotermitidae) are summarized and assessed There is only one wing-padded instar (non-quiescent), and the development, called proneometaboly (new term), is externally similar to the acercarian neometaboly It is the first case of such a development among the universally hemimetabolous "polyneopteran complex"

Morphology, ontogeny, wing development, insect metamorphosis, ametaboly, prometaboly, hemimetaboly, proneometaboly, neometaboly, remetaboly, diametaboly, allometaboly, homometaboly, parametaboly, holometaboly, anaptery, Hexapoda, Isoptera, *Prorhinotermes*, Thysanoptera, Hemiptera

INTRODUCTION

The development of macropterous forms of pterygotan insects is usually gradual, with several juvenile instars possessing external wing pads There are only three exceptions from this general scheme In the Acercaria (= Paraneoptera less Zoraptera), there are several taxa with abbreviated wing development and quiescent instars (a). The particular situations in these taxa were evolved independently, but the high frequency of this phenomenon jointly with close relationship of the taxa concerned indicate common genetical background ("underlying synapomorphy" sensu Saether 1976) The plesiomorphic situation in the Holometabola is presence of only one exopterous (and nearly always quiescent) juvenile instar – the pupa (the possible existence of several exopterous pharate pupal instars in some Strepsiptera is an apomorphy (Sehnal et al 1996) (b) The third exception exists in termite genus *Prorhinotermes*, in which only the last larval (= nymphal) instar possesses the wing pads (c) This has been published already by Miller (1942), but has never been noticed by general entomologists

In this paper, we provide first the commented overview of the modern classification of insect metamorphoses, as suggested by Sehnal et al (1996), with a special emphasis on neometabolous situations Second, we discuss a recently neglected neometabolous condition, the homometaboly

in some aphids, and point out a curious mode of development of wing pads shared by some non-neometabolous Acercaria Third, we summarize the knowledge of strange developmental phenomena (and other peculiarities) occurring in the genus *Prorhinotermes* (Rhinotermitidae), and assess them within the context of classification of metabolous modes

1. Overview of kinds of insect metamorphosis

1 1 Metamorphosis

The term *metamorphosis* is understood in two ways in entomology (a) sum of all the postembryonic developmental changes terminated by appearance of sexually reproducing adult instar, or (b) an abrupt and far-reaching change in anatomy at some of the molts (b1 applied to postembryonic development as a whole, or b2 concerning a single organ or organ system) Sehnal et al (1996) have reviewed and interpreted the situation, accepted the conception (b), stressed its comprehensive aspect (b1), and classified the postembryonic developments as summarized below (rejecting many superfluous terms and categories which obscure basic situations and have limited utility only – for an outdated but up to the time complete list of terms see Handlirsch (1926)) The below review and discussion of taxonomy of the metamorphosis basically derives from that by Sehnal et al (1996), but in some respects modifies their views

1 2 Modern classification of insect ontogenies based on Sehnal et al (1996)

For references to comments (1 3) see the parenthesized letters in italic, terminating the individual entries

(a) AMETABOLY – no metamorphosis, adult molts present,

(a1) *Apterous ametaboly* – no wings or wing pads in juveniles and adults, no final instar (all primarily wingless insects, i e Collembola, Campodeina, Japygina, Archaeognatha, Zygentoma, but possibly excluding the Protura) (*a*),

(a2) *Alate ametaboly* – at least several older juvenile instars functionally alate, adults winged, existence of final instar unknown (some extinct taxa of the Pterygota, never an extant condition),

(b) METABOLY – metamorphosis present, adults winged, no adult molts, terminal instar predetermined,

(b1) *Prometaboly* – several older juvenile instars with immobile wing pads ever increasing in size, the last juvenile (*subimago*) with functional wings (most Ephemeroptera) (*b)*,

(b2) *Hemimetaboly* – several older juvenile instars with immobile wing pads ever increasing in size, (some Ephemeroptera, Odonata, "polyneopteran complex" *s latiss* , Acercaria less neometabolous groups mentioned sub b3) (*c, e*),

(b3) *Neometaboly* (see Table 1) – metamorphosis accompanied by striking morphogenetic changes taking place in quiescent instars and similar to those occurring in holometabolous insects, the last two juvenile instars quiescent and provided with wing pads (*parametaboly* in males of Coccomorpha, *remetaboly* type I in Thysanoptera Terebrantia), or structurally as above but quiescence involving the additional pad-less instar preceding the two wing-padded instars (*remetaboly* type II in Thysanoptera Tubulifera), or none of the juveniles provided with wing pads, and only the last juvenile instar really quiescent (*allometaboly* in the Aleyrodomorpha) (Acercaria Thysanoptera and Sternorrhyncha, *partim*) (*d, e*),

(b4) *Holometaboly* – all but the ultimate juvenile instars without wing pads (wing rudiments present as internal invaginations or wing discs, hence the group known under the name Endopterygota as well), the last one (*pupa*) quiescent and exopterous, provided with external immobile wings (Holometabola) (*f, g*) Holometabolous development differs from all the previous ones (with the exception of some neometabolans) also in absence of any external rudiments of genitalia in the juvenile instars preceding the pupa

Table 1 Occurrence of neometaboly (N) and anaptery within the Acercaria (plesiomorphous condition = hemimetaboly, H)

1 Psocodea – H		
2 Condylognatha		
2 1 Thysanoptera		
2 1 1 Terebrantia – N *remetaboly*		
2 1 2 Tubulifera – N *diametaboly*		
2 2 Hemiptera		
2 2 1 Sternorrhyncha		
2 2 1 1 Psyllomorpha – H (*anaptery*)		
2 2 1 2 Aleyrodomorpha – N *allometaboly*		
	Aphidomorpha	Aphidoidea – H
		Adelgoidea – N *homometaboly*
	Coccomorpha	males – N *parametaboly*
		females – H (with modifications)
2 2 2 Euhemiptera		
2 2 2 1 Cicadomorpha *sed mut* – H		
2 2 2 2 Fulgoromorpha *sed mut* – H		
2 2 2 3 Heteropterodea *sed mut*		
2 2 2 3 1 Coleorrhyncha – H (*anaptery*)		
2 2 2 3 2 Heteroptera		
2 2 2 3 2 1 Enicocephalomorpha	Enicocephalidae – H (*anaptery*)	
	Aenictopecheidae – H	
2 2 2 3 2 2 Euheteroptera – H		

1 3 Comments upon the classification of insect metabolies

(*a*) The development of the Protura remains in too many points enigmatic, and we concur with Sehnal et al (1996) in provisionally omitting the group from classification Adults of some non-pterygotan taxa (e g , Campodeina – Rusek pers comm) alternate in the adult stage reproductive and non-reproductive instars which differ structurally

(*b*) We agree with those (Sehnal et al 1996) who interpret the ephemeropteran subimago as the last larval instar instead as an instar homologous to the pupa or to the first of the two adult instars

(c) Some secondarily apterous pterygotan taxa would structurally qualify for being characterized as *secondarily ametabolous* (e g , Grylloblattodea, Phthiraptera, female Coccomorpha) The term has been rejected since homoplasies are involved, adults do not molt, the final instar is predetermined, and only a modification of otherwise modal hemimetaboly (particularly distinct in development of grylloblattodean genitalia) is involved Moreover we are concerned with macropterous taxa only, and the involvement of taxa with secondarily reduced or absent wings in the adult stage would unnecessarily complicate the situation

(d) At purely descriptive level, disregarding the phylogenetic assessment, the "*neometaboly*" (see Table 1) covers a heterogeneous collection of situations having in common presence of 1–3 quiescent and metamorphing instars of which 0–2 are provided with wing pads (the aleyrodomorphan *allometaboly* with no wing pads in juveniles exceeds in this respect the situation obtaining in the Holometabola) The term *neometaboly* is justified, suggesting homoplasic evolution to that of the holometaboly, however, individual descriptive terms (as used above) are preferable when taxon-specific situations are considered Taking the descriptive viewpoint, the *remetaboly* in the Thysanoptera should receive two terms "*remetaboly* type I" in the Terebrantia = *REMETABOLY* (two quiescent wing-padded juvenile instars), and "*remetaboly* type II" in the Tubulifera = *DIAMETABOLY* (**new term**, three quiescent juvenile instars, the two last ones with wing pads) For *homometaboly* and *anaptery* see Chapter 2

(*e*) Within the hemimetabolous and neometabolous insects (mainly in the Hemiptera) there frequently occur special developmental situations associated either with peramorphic development (apomorphically earlier occurrence of wing pads), or with wing reduction in adults (delayed occurrence of wing pads). These cases do not have and do not require a special terminology, and form rather a continuum (for some aberrant situations in the Heteroptera see Štys & Davidová-Vilímová 1989).

(f) At least some species of the Strepsiptera (suborder Stylopidia) may have more than one exopterous "instars" within the pupal cuticle – for most recent discussions and the relevant literature see Sehnal et al. (1996) and Kristensen (1999). The unresolved problem is whether true pharate instars (a unique, morphologically extremely interesting reversal) or just the ecdysial cuticles (not an infrequent apomorphy) are involved.

(g) The last prepupal instar is partly quiescent in many groups of holometabolans. In many others, particularly in nest parasites and endoparasites or endoparasitoids (of both plants and animals), the individual larval instars may be strikingly structurally different (particularly if the first larva is free-living and invasive); often 1–2 larval instars may be reversibly or irreversibly quiescent. These individual situations have been variously termed, but the special names are not necessary for general developmental considerations (Sehnal et al. 1996). Admittedly, the diversity of holometebolans ontogenies is underplayed (say, against the neometabolous ones) in the above classification, but there is a good reason for it. Neometabolous ontogenies are parallelisms evolved from the hemimetaboly which is certainly a plesiomorphous situation in the modern Metapterygota (= Pterygota less Ephemeroptera), though the hemimetaboly itself is possibly a homoplasious parallelism evolved several times from alate ametaboly (Sehnal et al. 1996 based on Kukalová-Peck 1992). On the other hand, all the unusual holometabolan situations are just superimposed as homoplasious "secondary apomorphies" upon the major monophyletic "primary apomorphy", i. e. the holometaboly. Nevertheless, the unusual holometabolan ontogenies do certainly require a special terminology which should be based on comprehensive assessment of all the situations (especially in parasitoids).

2. Homometaboly in the Sternorrhyncha, and anaptery in the Hemiptera (Tab. 1, Fig. 1)

Neometabolous development includes in almost all the textbooks (e. g., Strünpel 1983) still another category in addition to *remetaboly* (incl. *diametaboly*), *parametaboly* and *allometaboly* – the *homometaboly* (term coined probably by Börner 1909 fide Handlirsch 1926). The latter term covers the situation in some aphids (Acercaria: Hemiptera: Sternorrhyncha: Aphidomorpha: Adelgoidea: Adelgidae and Phylloxeridae) in which the appearance of external wing pads of future alate females is postponed to the last (4th) quiescent juvenile instar. Contrastingly, the other aphids – disregarding their often complex life cycles and species-specific apomorphies – are hemimetabolous, and their wing pads appear earlier in the development. The category and the term has been omitted by Sehnal et al. (1996), being, perhaps, regarded as a trifle apomorphic modification of the acercarian hemimetaboly (our former opinion as well).

Now we are convinced that the *homometaboly* should be recognized as a distinct neometabolan mode. Though Sehnal et al. (1996) stressed the comprehensive aspect of the hexapodan metamorphosis, the mode of wing development still plays the major role in its classification. Homometabolan situation is clear-cut enough, and it is tempting to assess it (particularly when the existence of quiescent stages is taken into account) as an anagenetical predecessor to the aleyrodomorphan allometaboly. Recent molecular studies (Campbell et al. 1994, 1995) have suggested that the Psyllomorpha is a sternorrhynchan sister-group to the Aleyrodomorpha + (Aphidomorpha + Coccomorpha) while the orthodox phylogenetic hypothesis (Schlee 1969a, b) had been as follows: (Psyllomorpha + Aleyrodomorha) × (Aphidomorpha + Coccomorpha). Hence the occurrence of neome-

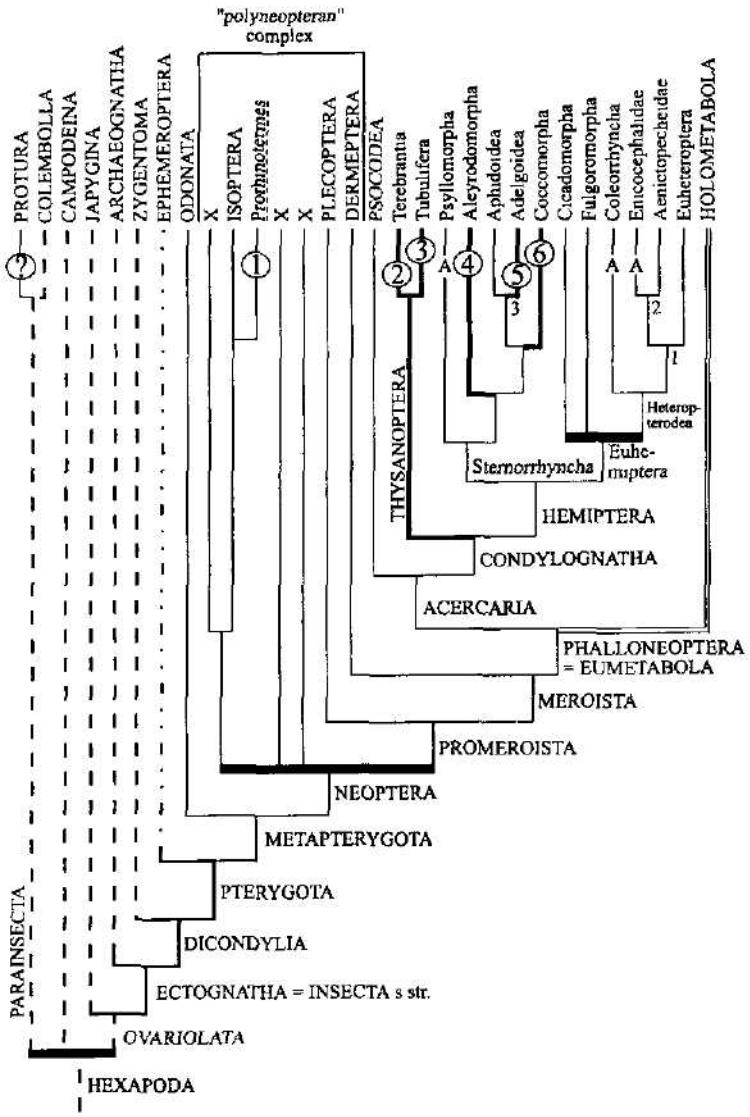
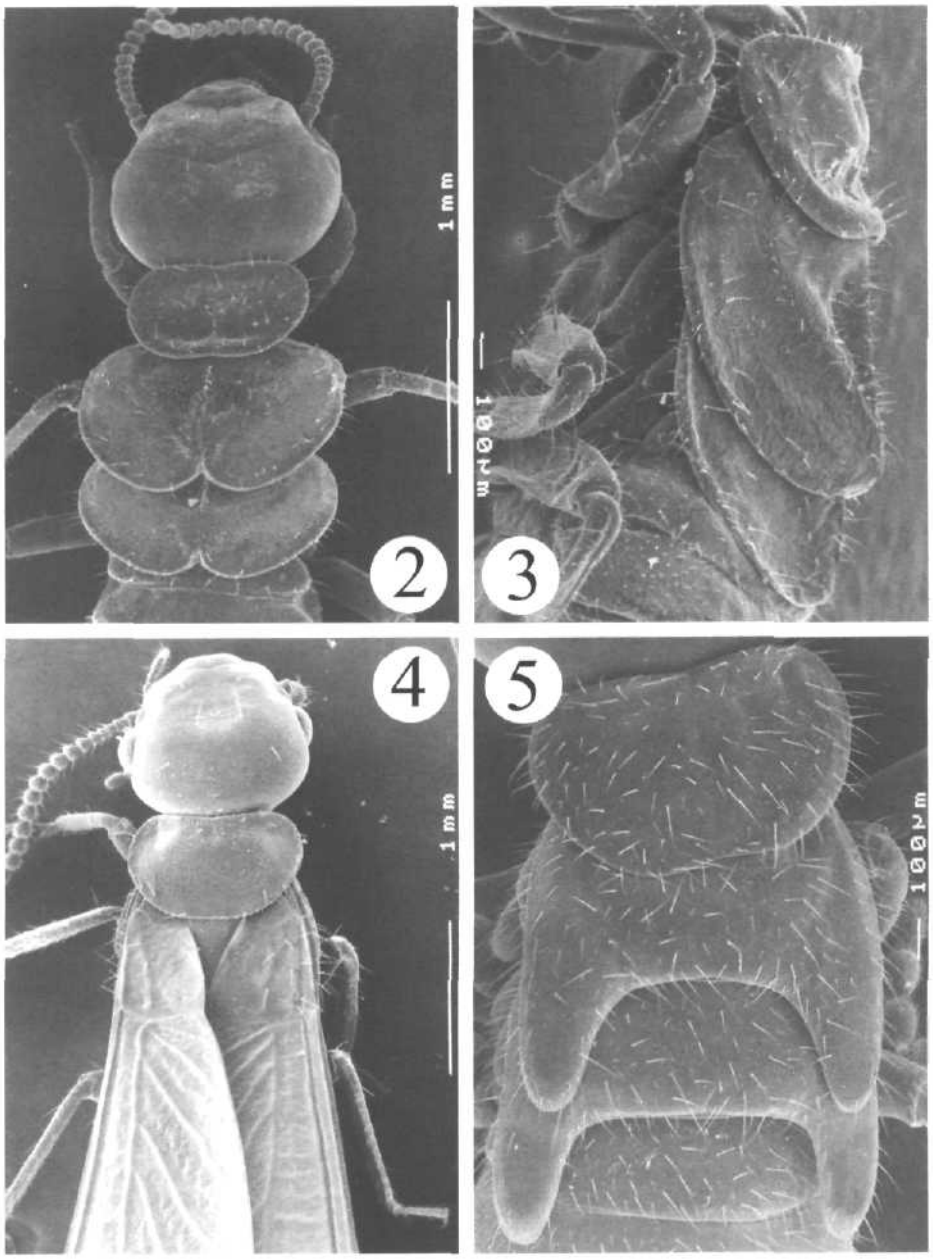


Fig 1 Simplified cladogram of Hexapoda (based on Bunning 1993 and pers comm , Kristensen 1991, Štys & Bilinski 1990, Štys et al 1994, and Štys, unpubl) with developmental types imposed Of the "polyneopteran complex" only the supposedly well resolved orders (Plecoptera and Dermaptera), and the Isoptera are shown Terminal taxa are of diverse ranks; those of ordinal and higher levels are printed in capitals. Superordinate taxa to those of lower ranks as well as high non-terminal taxa are either named direct in the cladogram, or mentioned in explanations. Only modern ontogenetic modes and taxa are considered, hence occurrence of afate ametaboly is not shown Explanations 1 – Heteroptera, 2 – Enicocephalomorpha, 3 – Aphidomorpha, 1 – pronecometaboly in *Prothinotermes*, 2 – remetaboly, 3 – diametaboly, 4 – allometaboly, 5 – homometaboly, 6 – parametaboly, A – anaptery (shown in the Acercaria only), ? – developmental mode unknown Heavy bar – unresolved relationships, ——— – apterous ametaboly, – .–.–.– – prometaboly, thin line – hemimetaboly, thick line – neometaboly, double line holometaboly.



Figs 2–5. Aspects of forewing development in the Rhinotermitidae. 2–4. *Prorhinotermes simplex* (Hagen). 2 – Nymph, anterior part of body, dorsal view. The fused shield-like wing pads are distinctly visible. 3 – Nymph, thorax, lateral view. The delimitation of forewing pads already distinct (no anaptery). 4 – Alate imago, anterior part of body, dorsal view. Wings developed as in other termites. 5 – *Reticulitermes lucifugus* (Rossi), nymph, thorax, dorsal view. Wing pads developed as in other termites, and in most species of the "polyneopteran assemblage".

taboly in the Sternorrhyncha other than Psyllomorpha would rather suggest an existence of a common underlying synapomorphy (*sensu* Saether 1976) rather than simple convergent homoplasy. All this seems still more intriguing regarding the universal existence of neometaboly in the Thysanoptera forming jointly with the Hemiptera a monophyletic taxon Condylognatha. Never a genealogical link between the non-psyllomorphan Sternorrhyncha and the Thysanoptera has been suggested, but the neometabolous similarities do require an explanation.

There is also a usually overlooked similarity between basal Sternorrhyncha and the two basal clades of the Heteropterodea which deserves to be terminologically labelled. The forewing pads in the Psyllomorpha, Coleorrhyncha, Heteroptera: Enicocephalomorpha: Enicocephalidae (but not the Aenictopecheidae; all senior author pers. observ.) are delimited from the mesoscutal and mesoscutellar areas by a distinct sulcus (a peramorphic condition in comparison with the rest of the Acercaria). The latter condition is different from the modal one in the Acercaria in which the wing pads are confluent with the mesonotal area. Perhaps, the term *anaptery* [**new term**] could be used for the former condition. Modes of wind-pads development similar to anaptery are, of course, common in many hemimetabolous "polyneopterans", but they have never been reviewed, and neither the distribution of such phenomena as anastrepsiptery (Odonata, Ensifera, Caelifera) has been explained in the phylogenetic context.

The evolutionary assessment of neometaboly and anaptery will be provided in a revision of higher classification and phylogeny of the Acercaria (senior author in prep.).

3. *Prorhinotermes* and its metaboly

3. 1. Unique features of Prorhinotermes and development of its wings

Position of the genus *Prorhinotermes* Silvestri, 1909 within the Rhinotermitidae is not clear (Ahmad 1950, Krishna 1970, Ampion & Quennedey 1981), but all authors agree that *Prorhinotermes* is a very primitive member of the Rhinotermitidae. We tend to consider it (jointly with Ampion & Quennedey 1981, Roisin & Lenz 1999) as a sister group of the rest of rhinotermitids. *Prorhinotermes*

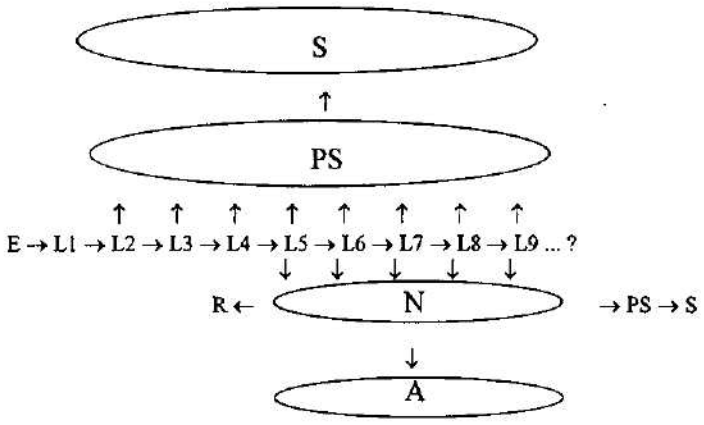


Fig. 6. All possible developmental pathways of *Prorhinotermes inopinatus* Silvestri (after Roisin 1988). The neotenic reproductives could arise from any individuum in at least fourth instar (Miller 1969). Abbreviations: E – egg, L (1 – 9) – larva of first to ninth instar, PS – presoldier, S – soldier, N – nymph (wing-padded larva), A – alate imago, R – individuum with regressed wing pads, morphologically undistinguishable from the old larvae.

differs from other rhinotermitids not only by plesiomorphic characters (presence of tergal glands in both sexes [Ampion & Quennedey 1981], the only single-site nester in the family [Shellman-Reeve 1997]) unique in the family, but also by several autapomorfies unique among all the termites. The wing pads (Figs 2–4) are not flat, but rather shield-like; the pads are short and fused together (Banks & Snyder 1920, Miller 1942); soldiers of *P. simplex* (Hagen, 1858) produce unusual defensive compound, 1-nitro-1-trans-pentadecene (Vrkoč & Ubik 1974). In most the termites, the shape of wing pads is modal (Fig. 5) for other representatives of "polyneopteran assemblage" (narrow pads extending posteriad from the meso- and meta-nota), while in *Prorhinotermes*, the pads are curved and connected apically. Another unique feature of *Prorhinotermes* is its distribution. Seventeen species of this genus (Snyder 1949, Myles 1998) are widespread on islands in tropics and subtropics, the reports from continents concern to coasts, and are very rare (Snyder 1949, Gay & Barrett 1983, descriptions of *Prorhinotermes* species from China inland remain questionable). This type of distribution indicate weak competitive abilities of this genus and capability of dispersal in floating logs or coconuts (Emerson 1955).

There is another exceptional character of some *Prorhinotermes* species. Young larvae of *P. inopinatus* Silvestri, 1909 and *P. flavus* (Bugnion et Popoff, 1910) possess strange finger-shaped appendages extending backwards from the pronotum (Roisin 1988). These appendages, which strongly resemble wing pads, usually persist until the third instar, but they could disappear after the first or further molts, persisting at most until the fourth instar (Roisin 1988). The function of these structures remains unknown. In *P. simplex*, no such appendages were observed in young larvae (F. Weyda & junior author pers. observ.).

The developmental pathways of particular castes were investigated in *P. simplex* (cf. Miller 1942) and *P. inopinatus* (cf. Roisin 1988), and it was found, that the development of castes is similar in both the species. The developmental scheme is much flexible (see Fig. 6). The individuals became active in third (smaller colonies) or fourth instar (larger colonies), and since that time they act as workers. The individuals of instars 5 and the following ones (see Fig. 6) can acquire wing pads after molting (but not necessarily) or they can became presoldiers or neotenic reproductives as well. Wing-padded individuals give rise to alate imagoes, but retain possibility of regression into apterous individuals, or into presoldiers or neotenic reproductives too. Alate polymorphism is due to origin of imagoes in different instars (Roisin 1988). The developmental pathways of *Prorhinotermes* contrast with those described in other rhinotermitids (pathways with imago line separated from worker line after the first or second molt) and is analogous to that of Kalotermitidae and Termopsidae (at least two instars with wing pads – Shellman-Reeve 1997).

3. 2. Metaboly in Prorhinotermes

The situation in *Prorhinotermes* is reminiscent to that of *homometaboly* in the Adelgoidea – only the last juvenile instar which would molt in the functionally alate adult instar is provided with wing pads, though it is not quiescent in the former case. Surely, the phenomenon is convergent, and nothing suggests parallelism to the neometabolous modes of development in the Acercaria. However, the *Prorhinotermes* situation is the first evidence of the capacity of the "polyneopterans" to evolve the condition similar to the incipient stages of acercarian neometaboly (Fig. 1). We may call it *proneometaboly* (**new term**), and it may heuristically stimulate a search for similar situations among the seemingly simple hemimetabolous developments.

Interestingly, the nymphs of *Prorhinotermes* are active throughout the whole instar (junior author pers. observ.). The development of wings is usually connected with a drastic changes in morphology and anatomy. This process requires complex rebuilding of insect body, therefore the instars with rapid wing development in neometabolous and holometabolous insects are usually (but not in *Prorhinotermes*) partially or fully quiescent.

There are three aspects of the development of wings in Prorhinotermes, which should be regarded as unique phenomena.

(A) The absence of the "worker-soldier branch" in the development of castes of *Prorhinotermes* could be either a symplesiomorphous character (shared with some more basal groups – Termopsidae and Kalotermitidae), or it may have evolved convergently in association with specific way of wood exploitation and instability of such food sources.

(B) Abbreviation (and postponement) of wing development in *Prorhinotermes* could be associated with instability of food sources, as well as in Kalotermitidae and Termopsidae (Shellman-Reeve 1997). Why is the development of wings condensed into the only one instar cannot be hypothesized at the moment.

(C) The unique shape of wing pads in *Prorhinotermes* is not easily explained because it seems that this shape does not provide better protection against damage to the pads in comparison with their modal shape in other termites. Rather the opposite seems true: the nymphs of *P. simplex* with damaged pads were occasionally observed (junior author pers. observ.), and the damage has been similar to that described in kalotermitids by Roisin (1994).

CONCLUSION

Taking into account the fact mentioned sub 1a, 2, and 3, we suggest the following modification of classification of insect ontogenies (Sehnal et al. 1996). New or reinstalled terms are italicized. Distribution is imposed upon a cladogram in Fig. 1.

1. Ametaboly
1.1. Apterous ametaboly
1.2. Alate ametaboly
2. Metaboly
2.1. Prometaboly
2.2. Hemimetaboly (some taxa with *anaptery*)
2.3. *Proneometaboly* (in *Prorhinotermes*)
2.4. Neometaboly (remetaboly in Terebrantia, *diametaboly* in Tubulifera, allometaboly in Aleyrodomorpha, *homometaboly* in Adelgoidea, parametaboly in Coccomorpha males)
2.5. Holometaboly (incl. its apomorpic conditions)

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REFERENCES

Ahmad M. 1950: The phylogeny of termite genera based on imago-worker mandibles. *Bull. Amer. Mus. Natur. Histor.* 95, 40–86

Ampion M. & Quennedey A. 1981: The abdominal epidermal glands of termites and their phylogenetic significance. *Systematics Association, spec. vol.* **19**: 249–261.

Banks N. & Snyder T. E. 1920. A revision of the nearctic termites. *US Natl. Mus. Bull.* **108**. 1–228

Börner C. 1909: Die verwandlung der Insecten, Vorläufige Mitteilung. *Sitzungsber. Gess. Naturforsch. Berlin* **5** 290–311

BUNING J 1993 *The insect ovary Ultrastructure, previtellogenic growth, and evolution* London Chapman & Hall, 400 pp
CAMPBELL B C, STEFFEN-CAMPBELL J D & GILL R J 1994 Evolutionary origin of whiteflies (Hemiptera Sternorrhyncha Aleyrodidae) inferred from 18S rDNA sequences *Insect Mol Biol* **3** 73–88
CAMPBELL B C, STEFFEN-CAMPBELL J D & GILL R J 1996 Origin and radiation of whiteflies an initial molecular phylogenetic assessment Pp 29–51 In D GERLING & R T MAYER (eds) *Bemisia 1995 Taxonomy, Biology, Damage, Control and Management* Andover, Intersct
EMERSON A E 1955 Geographical origin and dispersions of termite genera *Fieldiana Zool* **37** 465–521
GAY F J & BARRETT R A 1983 The occurrence in Australia of Prorhinotermes inopinatus (Isoptera Rhinotermitidae) *J Austral Entomol Soc* **22** 75–77
HANDLIRSCH A 1926 Allgemeine Einleitung in die Naturgeschichte der Insecta Pp 403–584 In KUKENTHAL W & KRUMBACH T (eds) *Handbuch der Zoologie, 4(1) Progoneata, Chilopoda, Insecta 1* Wien und Leipzig Walter de Gruyter & co, XIV + 892 pp, [1926–1930]
KRISHNA K 1970 Taxonomy, phylogeny, and distribution of termites Pp 127–152 In KRISHNA K & WEESNER F M (eds) *Biology of Termites, vol 2* Academic Press London, xvi + 687 pp
KRISTENSEN N P 1991 Phylogeny of extant hexapods Pp 125–140 In CSIRO (ed) *The Insects of Australia, Vol 1* Carlton Melbourne University Press, xvi+542 pp
KRISTENSEN N *P 1999* Phylogeny of endopterygote insects, the most succesful lineage of living organisms *Eur J Entomol* **96** 237–253
KUKALOVA-PECK J 1992 The "Uniramia" do not exist The ground plan of the Pterygota as revealed by Permian Diaphanopterodea from Russia (Insecta Palaeodictyopteroidea) *Can J Zool* **70** 236–255
MILLER E M 1942 The problem of castes and caste differentiation in Prorhinotermes simplex (Hagen) *Bull Univ Miami* **15** 3–27
MILLER E M 1969 Caste differentiation in the lower termites Pp 283–310 In KRISHNA K & WEESNER F M (eds) *Biology of Termites, vol 1* London & New York Academic Press, 598 pp
MYLES T 1998 http //www utoronto ca/forest/termite/rhino htm
ROISIN Y 1988 Morphology, development and evolutionary significance of the working stages in the caste system of Prorhinotermes (Insecta, Isoptera) *Zoomorphol* **107** 339–347
ROISIN Y *1994* Intragroup conflicts and the evolution of sterile castes in termites *Amer Natur* **143** 751–765
ROISIN Y & LENZ M 1999 Caste developmental pathways in colonies of Coptotermes lacteus (Froggat) headed by primary reproductives (Isoptera, Rhinotermitidae) *Ins Soc* **46** 273–280
SCHLEE D 1969a Sperma-Ubertragung in ihrer Bedeutung fur das phylogenetische System der Sternorrhyncha Phylogenetische Studien an Hemiptera I Psylliformes (Psyllina + Aleyrodina) als monophyletische Gruppe *Ztschr Morphol Tiere* **64** 95–138
SCHLEE D 1969b Die Verwandtschaftsbeziehungen innerhalb der Sternorrhyncha aufgrund synapomorpher Merkmale Phylogenetische studien an Hemiptera II Aphidiformes als monophyletische Gruppe *Stuttg Beitr Naturk* **199** 1–19
SEHNAL F, ŠVACHA P & ZRZAVY J 1996 Evolution of Insect metamorphosis Pp 3–58 In GILBERT L J, TATA V R & ATKINSON B G (eds) *Metamorphosis Postembryonic Reprogramming of Gene Expression in Amphibian and Insect Cells* San Diego, New York, Boston, London, Sydney, Tokyo Acad Press, Inc, xvi+687 pp
SHELLMAN-REEVE J S 1997 The spectrum of eusociality in termites Pp 52–93 In CHOE J & CRESPI B J (eds) *The Evolution of Social Behavior in Insects and Arachnids* Cambridge, New York, Melbourne Cambridge University Press 541 pp
SNYDER 1949 Catalog of the Termites (Isoptera) of the World *Smith Misc Coll* **112** 1–490
STRÜMPFL H 1983 Homoptera (Pflanzensaugen) Pp 1–262 In FISCHER M (ed) *Handbuch der Zoologie, 4 (28)* Berlin, New York Walter de Gruyter, VI + 262 pp
ŠTYS P & BILINSKI S J 1990 Ovariole types and phylogeny of hexapods *Biol Rev* **65** 401–429
ŠTYS P & DAVIDOVÁ-VILÍMOVA J 1989 Unusual numbers of instars in Heteroptera A review *Acta Entomol Bohemoslov* **86** 1–32
ŠTYS P, ZRZAVY J & WEYDA F 1994 Phylogeny of the Hexapoda and ovarian metamerism *Biol Rev* **68** 365–378
VRKOČ J & UBIK K 1974 1-Nitro-1-Trans-Pentadecene as the Defensive Compound of Termites *Tetrahedron Lett* **15** 1463–1464

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Nomenclatoric and taxonomic notes on Palaearctic Phalacridae (Coleoptera)

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Abstract The name *Phalacrus humberti* Tournier, 1889 is stated as homonym for *P humberti* Tournier, 1872 *P humberti* Tournier, 1872, *P humberti* Tournier, 1889, *P rufipes* Tournier, 1889 and *P quercus* Tournier, 1889 are proposed as junior synonyms of *P coruscus* Panzer, 1797, *P minutus* Tournier, 1889 as a junior synonym of *P substriatus* Gyllenhal, 1813 *P fimetarius* var *humberti* Rye, 1872, *Phalacrus humberti* Flach, 1888 and *Olibrus helveticus* Rye, 1876 are proposed as nomina nuda The name *Phalacrus nigrinus* (Marsham, 1802) due to its priority replaces *Phalacrus caricis* Sturm, 1807 *O sulcatus* Tournier, 1889 is proposed as a junior synonym of *O liquidus* Sturm, 1845 and *O bulgaricus* Reitter, 1899 as a junior synonym of *O gerhardti* Flach, 1888 The name of *O helveticus* Rye, 1876 is corrected as *O helveticus* Tournier, 1876 The lectotypus of *Phalacrus quercus* Tournier, 1889 *Stilbus polygramma* Reitter, 1868, *S meridianus* Švec, 1992, *S bifurcus* Švec, 1992, *S confusus* Švec, 1992, *S similis* Švec, 1992, *S chinensis* Švec, 1992 and *S interpositus* Švec, 1992 are transferred to the genus *Astenulus* Guillebeau, 1896

Taxonomy, nomenclature, Coleoptera, Phalacridae, Palaearctic region

INTRODUCTION

Due to participating on the forthcoming Catalogue of Palaearctic Coleoptera many of the original descriptions of the Palaearctic Phalacridae as well as the types have been studied This paper includes the results of the studies, which should be publishing ahead at last in 1999.

MATERIAL

The paper is based mainly on the material deposited in the author's collection and also on the Swiss Phalacridae coming from the Tournier's collection deposited in the Museum national d'Histoire naturelle, Paris (in the following text MHNP) Further the types deposited in MHNP, in the Hungarian Museum of the Natural History, Budapest (HNHM) and in the Deutsches Entomologisches Institut, Eberswalde-Finow (DEI) were examined

The data taken from the locality labels are given with authors' remarks placed in parentheses following data mainly of the specimens labeled or believed to be types They are concerning the way of writing of data One of the reasons is the information personally given by Claude Besuchet (Museum d'histoire naturelle, Genève) that the Tournier's material housed in MHNP is not labeled by the names on pins with beetles The names are indicated on labels fixed in entomological boxes and the beetles are stuck near them

RESULTS

Phalacrus coruscus (Panzer, 1797)

Anisotoma cornsca Panzer, 1797: 10
Phalacrus Humbertii Tournier, 1872: Rye 1872: 37, **syn. n.**
Phalacrus Humberti Tournier, 1889: 28, **syn. n.; hom. n.**
Phalacrus corruscus var. *Humberti* Tournier, 1876 Rye 1876: 177
Phalacrus fimetarius var Humberti Rye, 1872. Hetschko, 1930: 7, **nom. nud.**
Phalacrus Humberti Flach, 1888 Hetschko, 1930 8 **nom. nud.**
Phalacrus quercus Tournier, 1889. 8, **syn. n.**
Phalacrus rufipes Tournier, 1889 8, **syn. n**

MATERIAL EXAMINED *P humberti* Tournier, 1889, nec 1872 1 female, Peney, 9 Juin, Humbertii type (all handwritten), Type, Muséum Paris, Coll M Pic/Tournier (all printed); 1 specimen (sex indet), Peney, Muséum Paris, Coll M Pic/Tournier; 1 spec , Peney, 16 n 89, Muséum Paris, Coll. M Pic/Tournier, 1 spec , B. d Frer, 22 12 67, Muséum Paris, coll M Pic/Tournier, 4 spec , Peney, Muséum Paris, Coll M Pic/Tournier; (all deposited in MHNP under the name *humberti* Tourn n sp.) *P quercus* Tournier, 1889: Lectotype (here designated), female, Peney, type (handwritten), Muséum Paris, Coll. M. Pic/Tournier (printed); 1 male, B d Frer, 22.12 67, Muséum Paris, Coll M Pic/Tournier, 1 spec (sex indet), Saleve, 10 2 67, type decrit (handwritten), Type, Muséum Paris, Coll M Pic/Tournier (printed), 3 males, 1 female, Saleve, 10 9 67, Muséum Paris, Coll M. Pic/Tournier, (all MHNP under the name *quercus* Tourn n sp) *P rufipes* Tournier, 1889. female, Peney (handwritten), Musém Paris, Coll. M Pic/Tournier; (the specimen sticked in MHNP under label *rufipes* Tournier n sp)

REMARKS. *Phalacrus humberti*: *P. humbertii* Tournier, 1872 was described in the Rye's paper (1872) as "*Phalacrus Humbertii*, Tournier". In the original description it was mentioned that Tournier had examined a specimen probably coming from England which was sent to him by Rye for the determination. Tournier had recognized the specimen as a representative of valid species, new to science. According to the Article 50 (a) of the International Code of Zoological nomenclature, 1985, 3rd Edition, the species should be consider as described by Tournier with the date of the description 1872. Later Rye (1876) mentioned, that Tournier had consider the raxon for a variety of *P. coruscus* Panzer, 1797 (originaly only "a variety of *corruscus*"). Till now the species was mentioned (Hetschko 1930) under the name var. *Humberti* Rye, 1872 under *P. fimetarius* (Fabricius, 1775). Hetschko (1930) listed further *P. Humberti* Flach (1888) as a junior synonym of *P fimetarius*. This is incorrect because Flach (1889) did not describe any species under the same name but he mentioned *P. corruscus* v. *Humberti* Rye. Further Tournier (1889) described the species under the name *Phalacrus humberti*. Tournier as the author of this name was not mentioned in any of following papers. Tournier obviously based his species on the specimen sent to him by Rye for the determination, further on specimens from Switzerland cited in the material examined and also on specimens from France which are unknown to me. Tournier's specimens of *P. humberti* coming from Switzerland do not significantly differ from *P. coruscus*. Thus the nomenclatoric changes mentioned above are proposed

P quercus Tournier, 1889: Among the 7 specimens of *P. quercus* housed in MHNP only the female labeled "Peney" should be considered as the type. It is designated here as the lectotype. All Tournier's specimens mentioned under material examined above including the lectotype agree well in all external characters with *P. coruscus*. Till now (Hetschko 1930) the species was listed as a junior synonym of *P. brisouti* Rye, 1872.

P rufipes Tournier, 1889: Nearly certain the specimen examined is the type. It agrees well in all external characters to *P. coruscus*; thus it is proposed as a new junior synonym of the species mentioned. Till now (Hetschko 1930) it was considered for a variety of *P. fimetarius*.

Phalacrus nigrinus (Marsham, 1802)

Dermestes nigrinus Marsham, 1802 77.
Phalacrus caricis Sturm, 1807 80
Phalacrus milefolii Gyllenhal, 1813 429

REMARKS. The name *Phalacrus nigrinus* (Marsham, 1802) replaces *Phalacrus caricis* Sturm, 1807. Balfour-Browne first stated this nomenclatoric change in 1938. Later Thompson (1958) rejected it. The evidences presented by Balfour-Browne in his paper seems to be undoubtedly correct taking into account that Balfour-Browne had identified the type of Marsham's *Dermestes nigrinus* according its number in the Stephens's collection housed in the British Museum of Natural History, London as *Phalacrus caricis* Sturm, 1807. Thompson (1958) based his rejection of the Balfour-Browne's change only on belief that the original description was not fit to the specimen of *Dermestes nigrinus* deposited under the name *Cercyon nigrinum* in the Stephens's collection and further on the information that the true type was not preserved in the collection. Thus the change of the status of *P. nigrinus* according to Balfour-Browne is again proposed.

Phalacrus substriatus Gyllenhal, 1813

Phalacrus substriatus Gyllenhal, 1813. 428.
Phalacrus minutus Tournier, 1868: 143, **syn. n.**

MATERIAL EXAMINED *P. minutus*: female, Peney (handwritten), Muséum Paris, Coll. M.Pic/Tournier (printed) (MHNP).

REMARKS. Hetschko (1930) listed *P. minutus* as *P. substriatus* var. ? *minutus* Tourn., 1868. Although not labeled as a type, Tournier's specimen was stuck in MHNP under the name *minutus* Tourn. n. sp.. Thus the specimen is probably the type. Specimen – a female with pulled out rather damaged ovipositor – well agrees in all external characters with the original description and simultaneously with *P. substriatus*. No other specimen from the type locality labeled as *P. minutus* is present in the Tournier's collection. That is why it is proposed as a junior synonym of *P. substriatus*.

Olibrus flavicornis (Sturm, 1807)

Phalacrus flavicornis Sturm, 1807 78
Olibrus helveticus Tournier, 1876 Rye 1876. 177.
Olibrus helveticus Rye, 1876 Hetschko, 1930: 25, **nom. nud.**

MATERIAL EXAMINED *O. helveticus* Tournier, 1876. 1 male, 1 spec. (sex indet.), Peney, Juliet, Leontodon autumnale, Museum Paris, Coll. M Pic/Tournier, 1 spec., B. d. Frer, Juin 72, Muséum Paris, Coll. M Pic/Tournier; 1 female, B. d. Bex, 17 Aout, Muséum Paris, Coll. M Pic/Tournier, 1 male, London, Juin 72, Muséum Paris, Coll. M.Pic/Tournier; 1 male, 1 female, Peney, L. Aut., in copula, Muséum Paris, Coll. M.Pic/Tournier; 1 male, 1 female, B. d. Frer, Juin 72, type dessiné (handwritten), Type, Muséum Paris, Coll. M. Pic/Tournier (printed); (all in MHNP stuck under the name *helveticus* Tourn.).

REMARKS. Although 2 specimens were labeled as the types, the lectotype was not designated. The true type comes from Caterham.

In the original description (Rye 1876) it was mentioned that Tournier had returned to Rye a specimen coming from England under the name *Olibrus helveticus*. Rye (1876) named the species *Olibrus helveticus* Tournier. Tournier obviously had recognized the specimen as a representative of species new to science. According to the Article 50 (a) of the International Code of Zoological nomenclature, 1985, 3rd Edition, the species should be consider as described by Tournier with the date of the description 1876.

Taking into account the fact that eighth of nine of the Tournier's specimens including the specimens labeled as the types are *O. flavicornis* I propose *O. helveticus* Tournier, 1876 as a junior synonym of *O. flavicornis* (Sturm, 1807). The ninth specimen from London (Switzerland) is in fact *O. affinis* Sturm, 1807.

Olibrus liquidus Erichson, 1845

Olibrus liquidus Erichson, 1845 111
Olibrus sulcatus Tournier, 1889. 91, **syn. n.**

MATERIAL EXAMINED *O. sulcatus* 1 female, Peney, 24 VII 85 (handwritten), Museum Paris, Coll. M Pic/Tournier (printed) (in MHNP stuck under the name *sulcatus* Tourn.).

REMARK. Tournier's *Olibrus sulcatus* labeled as the type from Peney is a monstrous specimen with deeply sulcate elytra. The author identifies it as *O. liquidus*. The species was not mentioned in any literature since the year of its original description. The unfinished Tournier's work (1889) in which *O. sulcatus* was described in a key did mention neither type locality nor number of the types. So it was not possible to verify if the example examined is the type. But there is a high probability that the data about types were never published. That is why *O. sulcatus* Tournier, 1889 is proposed as the junior synonym of *O. liquidus* Erichson, 1845.

Olibrus gerhardti Flach, 1888

Olibrus gerhardti Flach, 1888 14.
Olibrus bulgaricus Reitter, 1899 158, **syn. n.**

MATERIAL EXAMINED *Olibrus bulgaricus* Reitter, 1899, holotype (sex indet), Bulg Stara Planina, leg E Merkl, holotypus; paratype, male, Bulg. Stara Planina, leg. E Merkl, Olibrus bulgaricus Rtt. n. sp., Bulgaria, all HNHM

REMARK. Both types of *Olibrus bulgaricus* agree well in main characters including the shape of male genitalia (examined in the paratype) with *Olibrus gerhardti*. Thus it is proposed for the junior synonym of *Olibrus gerhardti* Flach, 1888.

Astenulus polygramma (Flach, 1888), comb. n.

Stilbus polygramma Flach, 1888 75.

Material examined *Stilbus polygramma* Flach, 1888· holotype, female, Syria, Kaifa, Reitter (labelled by inknown entomologist as holotype); paratypes (labeled as syntypes), male, Syria, Kaifa, labeled by Flach as "Typ!, polygramma m"; female, Syria, (labeled by Flach as "polygramma m." Specimen labeled as holotype deposited in HNHM, the rest in DEI. *Astenulus micropus*, Guillebeau, 1896 holotype, male, Alluaud, Diego Suarez, Muséum Paris, Guillebeau, Coll Générale, Holotype, *Astenulus micropodus* n. sp. G (the name *micropodus* does not agree with the name *micropus* published in the original description)

REMARK. The specimen of *Stilbus polygramma* labeled as the holotype as well as the other types examined agree well in all generic significant characters with *Astenulus micropus* which is the type of the genus. Thus *Stilbus polygramma* Reitter, 1888 is transferred to the genus *Astenulus* Guillebeau, 1896.

Astenulus meridianus (Švec, 1992), comb. n.

Stilbus meridianus Švec, 1992 432

REMARK. The main generic characters in *Stilbus meridianus* are equal to those in the genus *Astenulus*. Thus *Stilbus meridianus* Švec, 1992 is transferred to the genus *Astenulus* Guillebeau, 1896.

Astenulus bifurcus (Švec, 1992), comb. n.

Stilbus bifurcus Švec, 1992. 434.

REMARK. The main generic characters in *Stilbus bifurcus* are equal to those in the genus *Astenulus*. Thus *Stilbus bifurcus* Švec, 1992 is transferred to the genus *Astenulus* Guillebeau, 1896.

Astenulus confusus (Švec, 1992), comb. n.

Stilbus confusus Švec, 1992· 436.

REMARK. The main generic characters in *Stilbus confusus* are equal to those in the genus *Astenulus*. Thus *Stilbus confusus* Švec, 1992 is transferred to the genus *Astenulus* Guillebeau, 1896.

Astenulus similis (Švec, 1992), com. n.

Stilbus similis Švec, 1992 436

REMARK. The main generic characters in *Stilbus similis* are equal to those in the genus *Astenulus*. Thus *Stilbus meridianus* Švec, 1992 is transferred to the genus *Astenulus* Guillebeau, 1896.

Astenulus chinensis (Švec, 1992), comb. n.

Stilbus chinensis Švec, 1992 438.

REMARK. The main generic characters in *Stilbus chinensis* are equal to those in the genus *Astenulus*. Thus *Stilbus chinensis* Švec, 1992 is transferred to the genus *Astenulus* Guillebeau, 1896.

Astenulus interpositus (Švec, 1992), comb. n.

Stilbus interpositus Švec, 1992 439

REMARK. The main generic characters in *Stilbus interpositus* are equal to those in the genus *Astenulus*. Thus *Stilbus interpositus* Švec, 1992 is transferred to the genus *Astenulus* Guillebeau, 1896.

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REFERENCES

BALFOUR-BROWNE J 1938 On Phalacrus nigrinus (Marsham, 1802) *Entomol Month Mag* **74** 56

ERICHSON W F 1845 *Naturgeschichte der Insecten Deutschlands Vol III* Berlin Verlag der Nicolaischen Buchhandlung, iv + 968 pp

ILLIG K 1888 Bestimmungs-Tabellen der Europaischen Coleopteren Familie Phalacridae *Verhandl Natur Ver Brunn* **27** 54–79

GUILLEBEAU F 1896 Descriptions de Phalacridae recueillis par M Ch Alluaud dans le Nord de Madagascar, en 1893 (Col) *Bull Soc Entomol Fr* **65** 296–299

GYLLENHAL L 1813 *Insecta Suecia descripta clasis I Coleoptera sive eleutherata Pars* III Leverenth Scaris ii+730 pp

HETSCHKO A 1930 Phalacridae In SCHENKLING S (ed) *Coleopterorum Catalogus, pars 108* Berlin W Junk 48 pp

ICZN 1985 *International Code of Zoological Nomenclature 3rd Edition* London International Trust for Zoological Nomenclature, 338 pp

MARSHAM T 1802 *Coleoptera Britannica, sistens Insecta Britanniae indigena secundum Linneum disposita Coleoptera* Londini White, 548 pp

PANZER G W F 1797 *Faunae Insectorum Germanicae Initia oder Deutschlands Insecten Vol 37* Nurnberg Felsecker 855 pp

REITTER E 1899 Elfter Beitrag zur Coleopteren-Fauna von Europa und angrenzenden Landern *Wien Entomol Ztg* **18** 155–161

RYE E C 1872 Notes on British Coleoptera, including three species new to our list *Entomol Month Mag* **9** 36–39

RYE E C 1876 Notes on British Coleoptera with descriptions of three new species *Entomol Month Mag* **101** 175–177

STURM J 1807 *Deutschlands Fauna* Nurnberg V Abt , 279 pp

ŠVEC Z 1992 A review of the Palaearctic species of the genus Stilbus (Coleoptera, Phalacridae) *Acta Entomol Bohemoslov* **89** 429–450

THOMPSON R T 1958 *Coleoptera Phalacridae Handbooks for the identification of the British insects Part 5 (b)* London Roy Entomol Soc , 17 pp

TOURNIER H 1868 Coleoptères nouveaux d'Europe, d'Algerie et d'Egypte *L Abeille* **5** 141–148

TOURNIER H 1890 Phalacridae *Entomol Genev* **1** 2–189

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In memory of Professor Sergěj Hrabě on his 100th birthday

Prof. RNDr. Sergěj Hrabě, DrSc., was born on 16 July, 1899 in Moscow and died on 29 March, 1984 in Brno.

Prof. Hrabě's parents come from Slaný in Bohemia, but they lived in Moscow. Prof. Hrabě attended elementary school in this country, but secondary school already in Moscow, where he also started his university studies. When revolution broke out in Russia, the Hrabě family returned to the newly established Czechoslovak Republic. He finished his university studies at the Faculty of Science, Charles University in Prague. After obtaining the degree of Doctor, he took a job as an assistant at the Zoological Institute of the Faculty of Science, Masaryk University in Brno. In 1933 he became associate professor and in 1938 he was to be nominated extraordinary professor. The closing down of the universities postponed his being appointed professor until 1946 (with effect from 1945), when he became full professor of general and systematic zoology. During the occupation he worked in the Research Institute of Agriculture in Brno. In 1946, after Prof. Zavřel's death, he became head of the Zoological Institute (later the Department of Zoology and Anthropology), which function he held until the year 1970. The renewal of the institute devastated by the war required an immense activity and manysided effort of the new head.

His scientific career began as early as during his university studies in Prague, where, at the instigation of his teacher, Prof. Al. Mrázek, some groups of ring worms became the centre of his attention; he dealt above all with the families Lumbriculidae, Phreoryctidae and Naididae.

The first publications of Prof. Hrabě were based on material collected on the territory of Sub-Carpathian Ruthenia. He caried out the sampling and the procession together with his contemporary and also specialist in Oligochaeta, Dr. Černosvitov. From the Sub-Carpathian Ruthenia they described a new genus and species *Anastylus parvus* and new species *Rhynchelmis vejdovskýi* and *Bythonomus subcarpaticus*. Besides, Prof. Hrabě collected material at numerous localities in Bohemia, Moravia and Slovakia. From those collections he described a number of new species and some genera: *Lamprodrilus mrázeki*, *Stylodrilus brachystylus*, *Moraviodrilus pygmaeus*, *Tubifex moravicus*, *Trichodrilus moravicus*, *Trichodrilus tatrensis*, *Tatriella slovenica*, *Paranais friči*, *Ilyodrilus vejdovskýi*, *Ilyodrilus mrázeki* and *Peloscolex zavřeli*.

Outside Czechoslovakia Prof. Hrabě made numerous trips abroad, particularly to the Balkans, where he obtained rich material. He devoted an extensive paper to Oligochaeta from Lakes Ochrid and Prespa (1931), where he also solved zoogeographical, phylogenetic and ecological problems: he carried out bathymetric distribution of Oligochaeta. From the taxonomic point of view he described many new species of the families Tubificidae, Lumbriculidae and Phreoryctidae. In the collections of Prof. Komárek from Lake Janina and from the Isle of Korfu he found another new genus and species *Epirodrilus michaelseni* and from the collections in Macedonia he described 7 new species. Also the lubriculid worm *Bythonomus sulci* found by Prof. Kratochvíl in the cave Pčelina pečina was described as a new species. Unique results were due to the procession of

material from the former Soviet Union from the acquisitions of the eminent limnologist, Prof. Behning which came from Lakes Chalgar, Issyk-Kul and Aral. Further he processed collections from the excursion of the Academy of Sciences, USSR, headed by the ichthyologist Prof. Berg. Various specialists sent him material for determination from other countries as well, such as Bulgaria, Romania, Iceland, the Congo, Ghana (reservoir on the Volta). Often are quoted his original papers on the fauna of marine Oligochaeta from the Black and the Mediterranean Seas. Altogether he processed biological material of Oligochaeta from 13 countries of Europe, Asia and Africa. The balance of his whole life are descriptions of 15 genera new for the science and 88 new species of Oligochaeta. The evaluation of his scientific work appeared in a six-language catalogue "Nomenclatura Oligochaetologica" by the authors J. H. Reynolds and D. G. Cook which appeared in Canada (1976). The authors of the catalogue rank Prof. Hrabě among the most eminent specialists in the group of limicolic oligochaetes and they evaluate highly his share in the cognition of the hitherto almost unknown sea fauna of tubifex worms. His valuable legacy for the further generation of specialists is the monograph: The Water Oligochaeta of Czechoslovakia (1981), published in Czech.

From anatomic papers his study of Enchytraeidae is worth mentioning. In them he described the mouth organs and explained their function; he also solved the problem of the so-called chromophillic cells and demonstrated their importance for metabolism.

Prof. Hrabě also paid attention to furher groups of invertebrate animals. With Prof. Absolon he described an interesting polychaete worm – *Marifugia cavatica* from caves in Herzegovina. From among crustaceans he dealt with Anostraca, Conchostraca, Amphipoda and Isopoda. In the High Tatras he discovered a new species for Czechoslovakia, a glacial relict – *Branchinecta paludosa*. At the Brno Reservoir he discovered another new species for Moravia – *Pectinatella magnifica*. This species was introduced to our country from North America. From the family Chironomidae he described a new species *Diamesa mohelnicensis* and he also described a new type of cysticersus found in *Lumbriculus variegatus* from Iceland.

Of fundamental importance was the publication of several volumes of "Klíč zvířeny ČSR" (The key of the fauna of the CSR) which originated at the instigation of Prof. Hrabě. He was editor of Volume I: Klíč zvířeny ČSR I (Key of the fauna of the CSR I) (1954), in which he processed some water groups of animals.

Besides invertebrates, Prof. Hrabě was also interested in fish, which is documented by the papers: "O potravě nejmladšího kapřího plůdku" (The food of the youngest carp fry) and "Kanibalismus kapřího plůdku" (Cannibalism of the carp fry) (together with Prof. Kostomarov). Of great importance for practical fishing was the publication of the manual "Klíč našich ryb" (Key to our fishes) (together with O. Oliva; 1953), where also the first find of the species *Proterorhinus marmoratus* on the territory of Czechoslovakia was described. This "Key" became a basis for the extended publication in the book "Stavovce Slovenska I" (The Vertebrates of Slovakia I) (together with O. Oliva and J. Lác; 1968) and for another manual "Klíč našich ryb, obojživelníků a plazů" (Key to our fishes, amphibians and reptiles) (together with O. Oliva and E. Opatrný; 1973).

Prof. Hrabě also dealt with general hydrobiological problems. From that sphere the most important is the paper "Bentická zvířena tatranských jezer" (The benthic fauna of the lakes of the Tatra Mts.) (1939) in which, on the basis of extensive material he built up his own typology of the lakes of the Tatra Mts. and objectively corrected Thienemann's distribution of lakes according to midge larvae.

Together with Prof. Zavřel, also interested in water fauna, Prof. Hrabě is one of the founders of the Brno hydrobiological school which is well known abroad.

Prof. Hrabě also paid great attention to pedagogical work. Already as an assistant of Prof. Zavřel he introduced a new branch of methodology – the microscopic technique which was an extraordi-

nary countribution to the scientific work of the graduates zoologists in the most varied biological branches. Thanks to him three university textbooks were published. He made it possible to publish the textbook Zoologie (Zoology) written by Prof. E. Bayer, because after the author's death he took over the edition of the book. He himself translated from Russian the textbook Zoologie obratlovců (Zoology of vertebrates) by S.P. Naumov (1955; 490 pages) and the textbook by V.A. Dogel devoted to the invertebrates (1961; 598 pages). The two textbooks were the only national textbooks of zoology for a long time. The pedagogical activity of Prof. Hrabě was characterized by immense accuracy, precision and didactic mastership. He laid great stress on practical identification of animals and their observation in the field. He cared for students irrespective of time and effort connected with it.

Professor Hrabě was also active in scientific and professional societies, where he worked in editorial boards, scientific commissions, etc. Thus, he was a member of the editorial board of the Věstník československé zoologické společnosti (The Bulletion of the Czechoslovak Zoological Society) and for many years the chairman of the Natural History Club of Brno (from 1954 after the death of J. Podpěra, a member of the Czechoslovak Academy of Sciences), where he unselfishly provided the lecturing, publication and excursion activities. The excursions organized by the "Club" were very popular with both students and the broad public.

In professional circles Prof. Hrabě was greatly esteemed. In his honour 12 taxa of the most varied animal groups were named, such as *Eophila hrabei* Černosvitov, *Beramyia hrabei* Mayer, *Spanotoma hrabei* Pagast, *Niphargus tatrensis hrabei* Karaman, *Protonemura hrabei* Raušer, *Onychiurus hrabei* Rusek, *Hrabiella periglandulata* Pižl et Chalupský.

As an appraisal for Czechoslovak science Prof. Hrabě was awarded the memorial Gold Medal (1969) of J. E. Purkyně University in Brno, today Masaryk University, and the Order of Labour (1970).

Professor Hrabě was an exceedingly modest, immensely industrious and singularly enthusiastic scientist and university teacher who ingratiated himself with everybody listening to him.

Věra Opravilová and Edmund Sedlák

BIBLIOGRAPHY OF ZOOLOGICAL PUBLICATIONS BY SERGĚJ HRABĚ

Scientific papers

1926

Uber eine neue Lumbriculiden-Art (Rhynchelmis Vejdovskýi n sp) *Zool Anz* **65**: 265–268 (with L. Černosvitov)

Un nouveau representant du genre Rhynchelmis Hoffm. (Rhynchelmis Vejdovskýi n. sp) *Věst. Král Čes. Společ Nauk (tř II)* **1926** 1–12 (with L. Černosvitov)

1927

Uber eine neue Lumbriculiden-Gattung Anastylus parvus n.g n.sp. aus Karpathorussland. *Zool Anz* **71** 203–207 (with L Černosvitov)

Rhynchelmis Komárecki, eine neue Lumbriculiden-Art aus Macedonien *Zool Anz.* **71** 170–175.

1929

Lamprodrilus Michaelseni, eine neue Lumbriculiden-Art aus Mazedonien *Arch Hydrobiol* **20** 163-179

Lamprodrilus mrázeki, eine neue Lumbriculiden-Art (Oligochaeta) aus Böhmen *Zool Jb Syst* **57**. 198–214.

Zwei neue Lumbriculiden-Arten, sowie einige Bemerkungen zur Systematik einiger bereits bekannter *Zool. Anz.* **84** 9–21

[Contribution to the knowledge of Moravian tubificids and lumbriculids] *Biol Listy* **14**: 1–6 (in Czech)

Uber die Oligochäten des Tschalkar-Sees *Rus. Gidrobiol Žurnal*, **8** 211–218 (with L Černosvitov)

1930

Uber einen neuen Susswasserpolychaeten aus den Hohlengewassern der Herzegovina *Zool Anz* **88** 249–264 (with K Absolon)

[Contribution to the knowledge of oligochaets from the lake Jantny, its surroundings and from the island of Corfu] *Věst Král Čes Společ Nauk (tř II)* **1930** 1–14 (in Czech)

1931

Uber eine Tubificiden-Gattung Epirodrilus (Oligochaeta) nebst Beitragen zur Kenntnis von Tubifex blanchardi *Zool Anz* **93** 309–316

Die Oligochaeten aus den Seen Ochrida und Prespa *Zool Jb Syst* **61** 1–62

1932

[Bythonomus Šulci n sp , un nouveau Oligochete cavernicole] *Příroda* **25** 1–3 (in Czech)

Sur la structure de l'organe buccal du pharynx, des glandes septales et des nerfs sympathiques chez les Enchytreides *Spisy Přír Fak Univ Brno* **159** 3–39

1933

Zur Kenntnis des Pelodrilus Kraepelini (Michaelsen) *Zool Anz* **104** 225–228

[Tubifex (Psammoryctes) moravicus n sp] *Sbor Klubu Přír Brno* **16** 48–52 (in Czech)

1934

Tubifex (Psammoryctes) moravicus n sp *Zool Anz* **107** 33–39

Das Mundorgan von Enchytraeus albidus, Achaeta bohemica und einigen anderen Enchytraeiden *Zool Anz* **106** 245–251

Bythonomus Šulci, eine neue Lumbriculiden-Art aus einer Hohle der Herzegovina *Zool Anz* **106** 314–317

Ein neuer Fundort von Branchinecta paludosa (O F Muller) in der Hohen Tatra *Arch Hydrobiol* **27** 277–285

[Uber die ungeschlechtliche Vermehrung des Bothrioneurum vejdovkýanum Štolc] *Sbor Klubu Přír Brno* **17** 13–18 (in Czech)

[On Pectinatella magnifica and some other bryozoids] *Věda Přír* **16** 89–92 (in Czech)

1935

[Uber Moraviodrilus pygmaeus n g n sp , Rhyacodrilus falciformis Br , Ilyodrilus bavaricus Oschm und Bothrioneurum vejdovskyanum Št] *Spisy Přír Fak Univ Brno* **209** 1–19 (in Czech)

[Oligochaeten des Issykkulsees] *Trudy Kirgiz Komplex Exped* , 3(2) 73–85 (in Russian)

1936

[Uber Dorydrilus (Piguetia) mirabilis n subgen n sp aus einem Sodbrunnen in der Umgebung von Basel sowie uber Dorydrilus (Dorydrilus) michaelseni Pig und Bichaeta sanguinea Bret] *Spisy Přír Fak Univ Brno* **227** 1–18 (in Czech)

Trichodrilus Strandi n sp , ein neuer Vertreter der Hohlen Lumbriculiden *Festschr Prof Dr E Strand* (Riga) **1** 404–407

[Zur Kenntnis der Oligochaeten des Aralsees] *Bull Sci Ac USSR*, No 6 1265–1276 (in Russian)

[An arctic anostract Branchynecta paludosa (O F Mull) in the High Tatra Mts] *Věda Přír* **17** 125 (in Czech)

1937

[Zur Kenntnis des Lamprodrilus mrázeki Hr , Aulodrilus pluriseta Pig und Aulodrilus pigueti Kow] *Sbor Klubu Přír Brno* **19** 3–9 (in Czech)

[Contribution a la repartition geographique d'Anostraca et de Conchostraca en Tchecoslovaquie] *Folia Entomol* **1** 33–39 *(in Czech)*

Contribution a l'etude du genre Trichodrilus (Oligoch , Lumbriculidae) et description de deux especes nouvelles *Bull Mus R Histor Natur Belg* **13** 1–23

1938

Trichodrilus moravicus und claparedei, neue Lumbriculiden *Zool Anz* **121** 73–85

[Beitrag zur Kenntnis der Fauna des Glatzer Schneeberges] *Sbor Klubu Přír Brno* **20** 1–10 (in Czech)

[Beitrag zur Kenntnis der Oligochaetenfauna Bohmens] *Sbor Klubu Přír Brno* **21** 1–8 (in Czech)

1939

[Oligochetes aquatiques des Hautes Tatras] *Věst Čs Společ Zool* **6–7** 209–236 (in Czech)

[Uber die ontogenetische Entwicklung des mannlichen Ausfuhrungsganges bei einigen Oligochaten] *Sbor Klubu Přír Třebíč* **3** 56–65 (in Czech)

[Uber die Bodenfauna der Seen in der Hohen Tatra] *Sbor Klubu Přír Brno* **22** 1–13 (in Czech)

1941

[Zur Kenntnis der Oligochaeten aus der Donau] *Práce Mor Přír Spol* **13** 1–36 (in Czech)

1942

[Zur Kenntnis der Brunnen- und Quellenfauna aus der Slovakei] *Sbor Klubu přír Brno*, **24** 23–30 (in Czech)

Der Kannibalismus bei der Karpfenbrut Arch Hydrobiol **40** 265–278 (with B Kostomarov)

[On benthic animals from the lakes in the High Tatra] *Physiographica Slovaca Čas Slov Učenej Spoloč* **1** 124–177 (in Czech)

1944

[To the occurrence of a conchostrac (Cyzicus tetracerus) in the region of Vodňany] *Folia Entomol* 7 15 (in Czech)

[Notes to the ecology of an anostrac (Streptocephalus torvicornis)] *Folia Entomol* **7** 27 (in Czech)

1946

[The food of Carp in its earliest age] *Sbor Klubu Přír Brno* **26** 30–39 (in Czech)

1948

[Respiratory system of Synurella ambulans] *Sbor Klubu Přír Brno* **28** 1–3 (in Czech)

1949

[On the Reduction of Silver Nitrate and Potassium Permanganate on Certain Parts of the Body of Asellus aquaticus and Synurella ambulans] *Zprávy Antropol Společ* **2** 1–8 (in Russian)

1950

[Oligochaeta from the Caspian Sea] *Práce Mor-Slez Akad Věd Přír* **22** 251–290 (in Czech)

1952

Oligochaeta 2 Limicola *The Zoology of Iceland*, II Part **20b** 1–10

1953

[The first report of a bryozoid Pectinatella magnifica Leidy in Moravia] *Scripta Medica* **26** 29–32 (in Czech)

[Zur Methodik der quantitativen Bestimmung der Heterodera-Zysten] *Prace Mor-Slez Akad Věd Přír* **25** 449–460 (in Czech)

1954

Trichodrilus macroporophorus n sp , eine neue Lumbriculiden-Art aus Osterreich *Zool Anz* , **153** 183–188

Porifera, Coelenterata, Turbellaria, Annelida, Bryozoa, Nemertini, Nematoda, Euphyllopoda, Anaspidacea, Mysidacea, Amphipoda, Decapoda In HRABĚ S (ed) *Klíč zvířeny ČSR I* [*Key to the identification of the animals of Czechoslovakia, Part I*] Praha Czechoslovak Academy of Sciences, 540 pp (in Czech)

1956

[Eine neue unbekannte Larve von der Unterfamilie Diamesinae (Tendipedidae, Diptera) aus Schlesien] *Publ Fac Sci Univ J E Purkyně v Brně* **372** 1–10 (in Czech)

1957

[An unknown type of cystucercoid in Lumbriculus variegatus from Iceland] *Publ Fac Sci Univ J E Purkyně v Brně* **385** 1–11 (in Czech)

1958

[Die Oligochaeten aus den Seen Dojran und Skadar nach dem von prof Dr S Stankovič gesammelten Material bearbeitet] *Publ Fac Sci Univ J E Purkyně v Brně* **397** 337–353 (in Czech)

A new species of Oligochaeta from the southwest of France *Notes Biospeologiq* **13** 171–173

1960

[Oligochaeta limicola from the collection of dr S Husmann] *Publ Fac Sci Univ J E Purkyně v Brně* **415** 245–277 (in Czech)

1961

[Two new species of the genus Rhynchelmis (Oligochaeta) from Slovakia] *Publ Fac Sci Univ J E Purkyně v Brně* **421** 129–146 (in Czech)

1962

[Oligochaeta limicola from Onega lake collected by Mr B M Alexandrov] *Publ Fac Sci Univ J E Purkyně v Brně* **435** 277–333 (in Russian)

[Rhizodrilus montanus n sp from the glacial lake in the Peristermountains in South Macedonia] *Publ Fac Sci Univ J E Purkyně v Brně* **435** 335–346 (in Czech)

1963

Rhyacodrilus subterraneus n sp , eine neue Tubificiden-Art aus den Brunnen in der Umgebung von Leipzig *Zool Anz* **170** 249 252

Oligochaeta limicola from Slovenija *Biol Vestnik* **11** 67–75

On Pelodrilus bureschi Mich *Biol Vesnik* **11** 77–78

On Rhyacodrilus lindbergi n sp , a new cavernicolous species of the fam Tubificidae (Oligochaeta) from Portugal *Bol Soc Portug Cienc Natur* **10** 52–56

1964

[On Peloscolex svirenkoi (Jarošenko) and some other species of the genus Peloscolex] *Publ Fac Sci Univ J E Purkyně v Brně* **450** 101–112 (in Czech)

1966

[New or insufficiently known-species of the family Tubificidae] *Publ Fac Sci Univ J E Purkyně v Brně* **470** 57–77 (in Czech)

[On some Naididae from the Volta lake in the Ghana] *Publ Fac Sci Univ J E Purkyně v Brne* **477** 373–387 (in Czech)

1967

[Two new species of the family Tubificidae from the Black Sea, with remarks about various species of the subfamily Tubificinae] *Publ Fac Sci Univ J E Purkyně v Brne* **485** 331–356 (in Czech)

1969

[Profesor dr František Vejdovsky] *Zprávy Čs Společ Dějv Věd Tech* **11** 23–29 (in Czech)

[On certain points in the structure of Tubifex minor Sok and Tubifex amurensis n sp Sokolskaja and Hrabě] *Publ Fac Sci Univ J E Purkyně v Brně*, **506** 259–264 (in Czech)

[Some remarks to the paper on Eulyodrilus thermalis (Pop)] *Publ Fac Sci Univ J E Purkyně v Brně* **506** 265–268 (in Czech)

[Peloscolex kožovi n sp from Bajkal lake] *Publ Fac Sci Univ J E Purkyně v Brně* **506** 269–272 (in Czech)

1970

[Notes on the genera Stylodrilus and Bythonomus (Lumbriculidae, Oligochaeta)] *Publ Fac Sci Univ J E Purkyně v Brně* **515** 283–309 (in Czech)

1971

A note on the Oligochaeta of the Black Sea *Věst Čs Společ Zool* **35** 32–34

On Trichodrilus pragensis Vejd (Oligochaeta, Lumbriculidae) *Věst Čs Společ Zool* **35** 205–208

On new marine Tubificidae of the Adriatic Sea *Scr Fac Sci Natur JEP Brunensis, Biol* **3**(1) 215–226

1973

A contribution to the knowledge of marine Oligochaeta, mainly from the Black Sea *Trav Mus Hist Nat Grigore Antipa Bucuresti* **13** 27–38

On a collection of Oligochaeta from various parts of Yugoslavia *Biol Vestnik* **21** 39–50

1974

[Bythonomus absoloni Hrabě, 1970, a lumbriculid from the Moravian Karst] *Klub Přírodověd v Brně Pr Ob Zool* **1974** 1–4 (in Czech)

Contribution to the further knowledge of Oligochaeta from lake Teleckoje in the Altai Mountains *Věst Čs Společ Zool* **38** 170–177

1975

Second contribution to the knowledge of marine Tubificidae (Oligochaeta) from the Adriatic Sea *Věst Čs Společ Zool* **39** 111–119

1980

Hrabě S 1980 Lamprodrilus jamburaensis sp n from the tundra on the bank of the Ob river (Oligochaeta, Lumbriculidae) *Věst Čs Společ Zool* **44** 101–104

1981

The freshwater Oligochaeta (Annelida) of Czechoslovakia *Acta Univ Carol – Biol* **1979** 1–167

1982
Contribution to the knowledge of Oligochaeta from the lake Baikal *Věst. Čs Společ Zool.*, **46** 174–193.

1983
Evolution of the family Lumbriculidae *Hydrobiologia* **102**. 171–173.

1984
On the occurence of Isochaetides newaensis (Mich) in Slovakia. *Klub Přírodověd v Brně Pr Ob Bot Zool* **1980–1983**: 71–75

Books

HRABĚ S & OLIVA O 1953 *Klíč našich ryb* [*Key to the identification of our fishes*].Praha. Nakl ČSAV, 100 pp (in Czech)

HRABĚ S. (ed) 1954 *Klíč zvířeny ČSR I* [*Key to the identification of animals of Czechoslovakea*]. Praha Nakl ČSAV, 540 pp (in Czech)

OLIVA O , HRABĚ S & LÁC J 1968: *Stavovce Slovenska I. Ryby, obojživelníky a plazy* [*Vertebrates of Slovakia I Fishes, Amphibians and Reptiles*]. Bratislava SAV, 389 pp. (in Slovak)

HRABĚ S , OLIVA O & OPATRNY E. 1973: *Klíč našich ryb, obojživelníků a plazů* [*Key to the identification of our fishes, amphibians and reptiles*] Praha SPN, 346 pp

Translations

NAUMOV P S 1954. *Zoologie obratlovců* [*Zoology of Verterbrates*] Praha SPN, 490 pp (translated from the original published in Moscow, 1950).

DOGEL V A 1961: *Zoologie bezobratlých* [*Zoology of Invertebrates*]. Praha: SPN, 598 pp (translated from the original published in Moscow, 1947).

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(b) Lonberg E. & Gustavson C. 1937. Contribution to the life history of the stripped wrasse. Ark. Zool. 29(7): 1–16.

(c) Lattin G. de 1967. Grundriss der Zoogeographie. Jena: Fischer Verlag, 602 pp.

(d) Makin D. 1989. The status of bats in Israel. Pp. 403–408. In: Hanak V., Horaček I. & Gaisler J. (eds.): European Bat Research 1987. Praha: Charles Univ. Press, 718 pp.

(e) Schornikov E. I. 1969. A new family of Ostracoda from the supralitoral zone of Kuril Islands. Zool. Zh. 48: 494–498 (in Russian, Engl. abstr.).

(f) Nikolajev G. V. 1987. Plastinchatousye zhuki (Coleoptera, Scarabaeoidea) Kazakhstana i Srednei Azii [Scarabaeoidaea (Coleoptera) of Kazakhstan and Central Asia]. Alma-Ata: Izd. Nauka KazSSR, 232 pp. (in Russian).

Nikolaev G. V. 1987. Plastinčatousye žuki (Coleoptera, Scarabaeoidaea) Kazahstana i Srednej Azii [Scarabaeoidaea (Coleoptera) of Kazakhstan and Central Asia]. Alma Ata: Izd. Nauka KazSSR, 232 pp. (in Russian).

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